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FOREST FLORA
OF
NORTH-WEST
AND CENTRAL INDIA.

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THE
FOREST FLORA
OF
NORTH-WEST AND CENTRAL INDIA.

THE
FOREST FLORA
OF
NORTH-WEST AND CENTRAL INDIA:

A HANDBOOK OF THE INDIGENOUS TREES AND SHRUBS OF THOSE COUNTRIES.

COMMENCED BY THE LATE
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CONSERVATOR OF FORESTS, PUNJAB.

CONTINUED AND COMPLETED BY
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INSPECTOR-GENERAL OF FORESTS TO THE GOVERNMENT OF INDIA.

PREPARED AT THE HERBARIUM OF THE ROYAL GARDENS, KEW.

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PREFACE.

The object of this work is entirely practical. As Forest administration in India advanced, the want of handbooks was felt, to enable forest officers to acquire a knowledge of the trees and shrubs in the forests, and of the climbers, epiphytes, and other plants which impede and injure the growth of trees. This want has led to the preparation of three works. *First*, The Flora Sylvatica of Madras, by Lt.-Col. R. H. Beddome, head of the Forest Department in that Presidency, commenced in 1868 and completed in 1873. It contains 325 plates of trees, with full descriptions, and a Manual giving a systematic account of 76 Natural Orders, comprising all trees and the more important shrubs of South India and Ceylon; 27 additional plates, with the analysis of 146 genera not figured in the work, are appended. *Second*, The Forest Flora of British Burma, by Sulpiz Kurz, Curator of the Herbarium at Calcutta, now under preparation. *Third*, The present work. When these three books are complete, they will comprise descriptions of most trees, a knowledge of which is needful to foresters, in British India. Thus the trees of the Bombay forests will be found either in Colonel Beddome's or in this work; and the more important trees of the Eastern Himalaya and Eastern Bengal will probably occur, some in this book, others in the Burma Flora. Eventually a Forest Flora of Bengal and Assam, and another of the Bombay Presidency, with local habitats and vernacular names, may become necessary; but at present the requirements of foresters in the different provinces of India will be sufficiently met by the publication of these three works.

The geographical limits of this Flora are necessarily artificial. The object was to give an account of the arborescent vegetation in the forest tracts of the Panjab, the North-West Provinces, and of those forests in the Central Provinces which are situated on the Maikal and Satpura range of mountains. The northern limit may be defined as the arid treeless zone of the inner Himalaya; while to the south the territory is bounded by the open forestless plain which skirts the base of the Maikal and Satpura range from Bilaspur to Berar. The western limit is the Panjab frontier, along the foot of the Suliman range; and eastward the territory is bounded by a broken line, which follows the Nepal frontier, first along the Sarda or Kali river, and afterwards parallel with the foot of the Himalaya, until it touches the great Gandak river. From that point, a straight line drawn in a south-south-westerly direction through Benares to Amerkantak and Bilaspur, may be regarded as the eastern boundary. Between the British territory of the Panjab and the North-West Provinces in the north, and the Central Provinces in the south, intervene the large and important native States of Rajputana, Malwa, and Bandelkhand; and as the arborescent vegetation of these States is very similar to that of the surrounding British territory, they have been included, as far as possible. For these districts my materials were scanty. It is much to be desired that the results of Dr George King's botanical exploration of this country may soon be published, and thus supply the deficiencies of this work in that respect. Most of the trees and shrubs of Sindh, and of the forest tracts of Guzerat, in the vicinity of the Mhye river, and south as far as the Mandevi forests on the right bank of the Tapti, are noticed.

The northernmost point is the head of the Kaghan valley, drained by a tributary of the Jhelam, in lat. 35°; and the forest tracts furthest west are the Belas, along the Indus in Sindh, in long. 68°.

It would be too large a subject were I to give a detailed account of the climatic conditions which influence the forest vegetation of this large territory. It must suffice to state that the following great climatic zones are included: *First*, The entire arid region of India, with a scanty and uncertain rainfall, and an atmosphere dry nearly throughout the year (South Panjab, Sindh, the States of Bhawalpur, Kairpur, Bikanir, Jessulmir, and the greater part of Marwur). *Second*, The entire northern dry zone, surrounding the arid region on the north and east, forming a belt from 100 to 200 miles wide, with a normal annual rainfall between 15 and 30 inches, which includes the plains of north and north-east Panjab, outside the sub-Himalayan tract, Delhi, Ajmir, Gwalior; and of the Rajputana States, Bhurtpur, Jeypur, and Meywar. *Third*, The western end of the north-eastern moist zone, with a heavy monsoon and an annual rainfall exceeding 60 inches, which comprises the Burma coast, Bengal, the sub-Himalayan tract, and the outer ranges. That portion of this moist zone which extends into the territory of this Flora is a narrow belt, probably nowhere more than 30 miles wide, narrowing gradually towards the north-west, and terminating at the Ravi. It includes part of the Gorakhpur and the northern Oudh forests, the Siwalik tract, the Doons, and the outer ranges of the north-west Himalaya. *Fourth*, A portion of the large intermediate region, which comprises the whole of Central and a large portion of the plains of North India, as well as the intermediate Himalaya, which is situated between the outer narrow moist belt and the inner arid region of Tibet. Entirely beyond the limits of the present Flora are the southern dry region, including eastern Mysore and part of the Dekkan, and the moist zone of Western India, comprising the Western Ghats from the Khandeish Dangs to Travancore, the country below the Ghats, and a narrow strip of country above the Ghats.

A glance at this handbook will show that in many instances Indian trees or shrubs have been maintained distinct which had been referred to European species by Dr Stewart and other botanists. It will also be noticed that a considerable number of Himalayan trees and shrubs have been identified with species indigenous in Europe and the Mediterranean region. This identification has in every case been based upon critical research. The following are well-known European species included in this Himalayan Flora: *Berberis vulgaris, Myricaria germanica, Rhus Cotinus, Prunus prostrata, P. Padus, Rubus fruticosus, Rosa moschata, Pyrus Aria, Cratægus Oxyacantha, C. Pyracantha, Ribes Grossularia, R. nigrum, Hedera Helix, Lonicera alpigena, Sambucus Ebulus, Hippophaë rhamnoides, Elæagnus hortensis, Viscum album, Celtis australis, Platanus orientalis, Buxus sempervirens, Salix alba, S. hastata, S. daphnoides, S. viminalis, Populus alba, Quercus Ilex, Corylus Colurna, Ephedra vulgaris, Juniperus communis, Pinus excelsa,* and *Taxus baccata.* The forester who is transferred from Europe to the north-west Himalaya thus finds himself surrounded by trees belonging to the same families and genera as those which compose the forests of Europe, and also in many instances recognises the very species with which he was familiar in his native country.

In the forests of the plains and lower hills, three remarkable features attract attention. *First,* The large number of trees of South India and Burma which occur in the moist forests of the sub-Himalayan tract. Some of these extend no farther than the Sarda, and within our limits are only found in the Gorakhpur and Oudh forests; for example, *Dillenia aurea, Polyalthia suberosa, Amoora Rohituka, Heynea trijuga.* Others, such as *Dillenia pentagyna, Miliusa velutina, Schleichera trijuga,* have the same north-western limit, but are likewise found in the forests of the Satpura range. Others, again, extend along the foot of the Himalaya to the Indus (*Bombax malabaricum, Odina Wodier, Cassia Fistula, Albizzia odoratissima* and *stipulata, Acacia Catechu, Terminalia bellerica,* and *Eugenia Jambolana*). Rattan-brakes (*Calamus Rotang*) extend only to the Dehra Doon; the last patches of *Sal* are found on the Siwaliks between the Sutlej and Bias, and in the Kangra valley north of the latter river; and the most western Bamboo forest (*Dendrocalamus strictus*) is on the west bank of the Jhelam river. The *second* prominent feature is, that a number of trees attain their northernmost point in Central India, and are not found in the sub-Himalayan tract—as, for example, *Ailanthus ex-*

celsa, *Soymida febrifuga*, *Chloroxylon Swietenia*, *Pterocarpus Marsupium*, *Hardwickia binata*, *Cordia Macleodii*, *Spathodea xylocarpa*, and *Tectona grandis*. The *third* remarkable feature of the arboreous vegetation of North-West India is the large number of African and Arabian species, many of which find their eastern limit within the territory of this Flora. *Capparis aphylla* extends from Timbuktu on the Niger to Bandelkhand, *Tamarix articulata* from Central Africa to the Jumna, *Salvadora oleoides* from Aden to Agra, *Cordia Rothii* from Abyssinia to Rajputana, and *Calligonum polygonoides* from Algeria to Meywar. Other western trees, which do not, however, extend to Africa, are *Acacia rupestris* (unless, as seems probable, it should be referred to *A. Senegal*, in which case it would rival *Capparis aphylla* in the extent of its range), *Acacia modesta*, *Prosopis spicigera*, and *Diospyrus Lotus*.

The number of indigenous shrubs and trees described is about 700, and about 80 introduced and cultivated plants have been added. Of these, many, such as *Michelia Champaca*, *Mangifera indica*, *Saraca indica*, are natives of other parts of India, Burma, or Ceylon; a few are natives of Western Asia—*Prunus Amygdalus*, *Ficus Carica*, *Salix babylonica*, *S. Caprea*, *Populus nigra*, and *Cupressus sempervirens*. Africa has furnished *Adansonia digitata*, *Indigofera tinctoria*, *Sesbania ægyptiaca*, *Coffea arabica*, *Euphorbia Tirucalli*, and (probably) *Tamarindus indica*. The number of American trees and shrubs introduced into Northern India is remarkable: *Anona squamosa*, *Bixa Orellana*, *Parkinsonia aculeata*, *Pithecolobium dulce*, *Acacia Farnesiana*, *Psidium Guava*, *Carica Papaya*, *Opuntia Dillenii*, and *Plumeria acutifolia*, are old introductions; while *Swietenia Mahagoni* and the *Cinchonas* are of recent date, as also *Eucalyptus*, *Albizzia*, and *Acacia*, from Australia.

The selection of the indigenous and cultivated species to be included was to a certain extent arbitrary, and the guiding principles were different from those adopted in the other Forest Floras. The scanty vegetation on the extensive wastes and dry hills of the arid region often consists of low shrubs, which, in the moister regions of the Peninsula, Burma, and Bengal, would not be noticed by the forester; while in North-West India they are of great importance for the wellbeing of the population, and are therefore included. On the other hand, many shrubs of the Himalaya have been omitted. The numerous species of *Clematis* were excluded, because their admission would have necessitated the addition of the Order *Ranunculaceæ*, mainly composed of herbaceous plants of no particular interest to the forester. *Spiræas* are also omitted, though they are showy and conspicuous, and several are considerable shrubs. It would have been a great advantage if the large gregarious grasses *Saccharum*, *Andropogon*, *Imperata*, and others, which cover extensive areas in the Himalayan Terai, and on the Sailaba land along the main rivers, and the large herbaceous plants of *Compositæ*, *Acanthaceæ*, *Labiatæ*, and other Orders, could have been included, which come up on clearings in the forests (Schlagpflanzen), or form dense underwood in moist forests. This, however, must be reserved for a separate publication.

Again, the great similarity between the forest vegetation of the north-west Himalaya and of Europe suggested a brief notice of the more important European forest-trees. The fact is now becoming recognised that a knowledge of forests and forest management in Europe is useful to foresters in India. A considerable number of the younger forest officers have received their professional education in the public and private forests of France, Germany, and Britain; others have devoted their furlough to the study of forest management in those countries: and the connection between European and Indian foresters thus established will prove a great advantage to the development of forestry in India. Under these circumstances it was desirable that Indian foresters should have a brief account of European trees side by side with their congeners and allies of the Himalaya. Special reference has in this respect been made to the arborescent vegetation of the Mediterranean region, which is visited by many Indian officers on their way to and from England.

It was also necessary to include the more important trees and shrubs cultivated in North-West India, and to allude to those which, though not yet introduced or extensively cultivated, merit special attention, and which may perhaps be introduced with advantage. With the view of making the book more useful to persons engaged in Indian arboriculture, reference has been made to useful trees of other countries allied to those described in these pages.

These remarks will explain that this book must not be regarded as a local Flora, similar to the Colonial Floras which are emanating from Kew; for on the one hand it includes only the more important trees and shrubs, and on the other its scope has for practical purposes been extended far beyond its territorial limits. It has been written, not for botanists, but for practical men, especially for those who have the care of the public forests in the different provinces of India. It may, however, be said, that this object might have been attained by a smaller volume, giving only a popular description of the larger trees, and unencumbered with remarks regarding the identification of species and the priority of systematic names. Such objections will be supported by those who hold that the sole legitimate duty of forestry in India is to provide fuel and timber, and that the forester has no concern with bark, lac, gums, resins, caoutchouc, wax, oil, dyes, fruits, and other marketable products of trees and shrubs. Such views will continue to be maintained until it comes to be acknowledged that the principal aim and object of forest management in India is the formation of public estates, to be managed so as to secure large benefits to the country of an indirect nature, as well as a continuous and increasing yield of all descriptions of forest produce necessary to supply the requirements of the people and their export trade. Foresters in India will gradually understand that they are expected to make the utmost of the estates intrusted to their charge for the benefit of the present generation, while steadily improving the capital value and productiveness of their estates; and this will lead them eagerly to seek information regarding the various trees and shrubs which may be turned to account. It is not possible to predict in what respect any particular plants may not eventually be found useful, either by their produce, or because they further the growth of the more useful kinds by their shade and shelter, or in other ways. The only safe plan, therefore, is at the outset to take a comprehensive view of the whole forest vegetation, instead of confining our attention to those trees which we are accustomed, often erroneously, to regard as most important. Again, such study, to be profitable, must be conducted upon true scientific principles. Unless the identification of species and their systematic names are established, so as to command the assent of botanists, there can be no certainty as to what plant is meant, and the result of studies in the field will be confusion and waste of time. It may be well to state that the fault of this book is not that it is too scientific, but that it is not scientific enough. When the material here collected has been sifted by the criticisms of botanists in Europe, and tested by the studies in the field of Indian foresters and botanists, it may then be useful to prepare popular books of a smaller size for the use of those who have not the leisure or the inclination to study this handbook.

The botanical terms employed are explained in a small volume on Indian botany by Professor Oliver,* which should be in the hands of all who use this work without having had the advantage of previous botanical instruction. A list of terms not explained in that book is appended. Bentham's Outlines of Botany, reprinted in the commencement of Beddome's Manual, will also be found a most useful guide in this respect.

To the end of Rubiaceæ the systematic arrangement followed is that of Hooker's and Bentham's Genera Plantarum, and that standard work has been quoted under each Natural Order, in addition to Royle's and Wight's Illustrations. The remaining Orders have been arranged mainly in accordance with Bentham's Flora Australiensis. Standard works on Indian botany have invariably been quoted under each species, including Hooker's Flora of British India up to p. 306 of the first volume. Boissier's Flora Orientalis has also, as a rule, been referred to, as far as the end of the second volume. Under species common to North India and

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* First Book of Indian Botany. By Daniel Oliver, F.R.S. London, Macmillan and Co., 1869.

Europe, some standard European work has always been quoted—viz., Hooker's Students' Flora for British Plants, Reichenbach's Icones Floræ Germanicæ—wherever it seemed desirable to quote a good illustration, and when necessary for special reasons — Mathieu's admirable Flore Forestière de la France, and Willkomm's Forstliche Flora von Deutschland und Œsterreich, as far as that work had appeared. Reichenbach's Icones were selected, because vols. xi. and xii., which contain most arborescent genera of Central Europe, are sold separately at a moderate price. Other botanical works have been quoted where it appeared necessary for purposes of identification, but as sparingly as possible. A few Synonyms have been added, but only those used in standard books on Indian botany. Exceptions have occasionally been made in favour of names occurring in Wallich's catalogue, De Candolle's Prodromus, and a few other works.

The spelling of botanical names in Bentham and Hooker's Genera Plantarum has been adhered to, and in the subsequent Orders the practice of the leading botanists has been followed. Hence, among others, the old spelling of *Pyrus*, *Cinchona*, *Plumeria*, and *Briedelia*, has been maintained, though if the names were to be altered in accordance with their derivation, it would be necessary to write *Pirus*, *Chinchona*, *Plumiera* and *Bridelia;* but these are not the names under which the genera were originally described, and by which, with few exceptions, they have been known ever since.

After the systematic, English, and other European names of the tree, the Sanskrit name has been given wherever it seemed probable that it referred to the species described. In a few instances, Arabic and Persian names have also been added. The vernacular names which follow are, as a rule, arranged according to the provinces or districts in which they are used, but in many cases it was impossible to indicate the language to which they belong. In spite of all the labour bestowed on it, this portion of the book may be found one of its weakest points. Yet the critical examination of the vernacular names of the different Indian languages, and their derivation from the Sanskrit or other root, will be found a most interesting and important study. Forestry in India is as yet too much like an exotic plant. I have no greater wish in connection with it than to see it naturalised; and one of the first steps in that direction must be the establishment of fixed names and technical terms in the vernacular. The forester should not despise vernacular names, for in many instances they have a fixity which systematic names do not yet possess. We all know the evergreen *Khirni*, and there can be no mistake about it; but botanists are not yet agreed whether the tree shall be called *Mimusops indica*, *hexandra*, or *Kauki*. *Kamela*, or *Kamila*, is a well-known small tree; its systematic name among Indian botanists, however, which for more than half a century was *Rottlera tinctoria*, has now and properly been changed into *Mallotus philippinensis.* Again, there can be no doubt as to the tree designated by the name of *Kāo, Kāu,* although some botanists call it *Olea europæa*, others *Olea cuspidata*, and others *Olea ferruginea. Kaddam* and *Haldu* were formerly well known as *Nauclea parvifolia* and *cordifolia;* now the forester has to learn the new generic names *Stephegyne* and *Adina.* These changes of systematic names are not arbitrary—as a rule, they are dictated by the progress of scientific research; but they are apt to discourage the student—and on that account, also, vernacular names merit attention. All North Indian names have been spelt according to the system of Sir William Jones, now adopted in public documents, but with as few diacritical marks as possible. When it seemed necessary to indicate a long vowel, this has been done, in accordance with the practice of Forbes's Hindustani Dictionary, by a horizontal line, thus—*ā, ē, ī, ū.* Names which have acquired a fixity of spelling in English, such as *Teak, Toon, Sissoo, Neem, Hoom, Bamboo, Peepul, Banyan,* have not been interfered with. As a rule, North Indian names only have been given; but in a few instances Canarese, Telugu, and Burmese names have been added, in order to facilitate the use of the book in other provinces besides those for which it has mainly been written.

It may be useful to mention that trees which under ordinary circumstances do not exceed 20 ft. in height are termed small, while large trees are those which exceed 50 ft., and moderate-sized trees those between these limits. In indicating the rate of growth, the terms slow, moderate, and rapid have occasionally been used. These comparative terms are intended to relate to average conditions, for it is well known that the same kind may be a rapid grower under certain circumstances, and a slow grower under others. With this reservation, the following terms have been adopted in this handbook:—

Growth slow: more than 12 rings per inch of radius; age of a tree of 6 ft. girth, above 138 years.

Growth moderate: 4-12 rings per inch of radius; age of a tree of 6 ft. girth, 46 to 138 years.

Growth rapid: less than 4 rings per inch of radius; age of a tree of 6 ft. girth, less than 46 years.

Pure Forests are now commonly called those which consist entirely or nearly of one kind of tree, in contradistinction to mixed forests, composed of various kinds. The term *leaf-bearing trees*, though not literally correct, is used, in contradistinction to coniferous trees, in the sense of the French "Bois feuillus," and the German "Laubhölzer."

Concerning the information given on the physical properties of the different kinds of timber, it will suffice to state that the weight of a cubic foot is always that of seasoned timber, unless otherwise stated. Of the numerous experiments made to determine the mechanical properties of Indian timbers, the results of those only which relate to transverse strength have been given. P. is the constant represented by the following well-known formula.:—

$$P = \frac{L \times W}{b \times d^2}$$

L being the length in feet of the scantling tested between supports (bearing length), W the weight producing fracture of the scantling loaded in the middle, b breadth of scantling in inches, d depth of scantling in inches.

It now remains briefly to narrate the history of this work, to enumerate the materials upon which it is based, and to acknowledge the assistance received during its preparation. In 1869, the late Dr Stewart, then Conservator of Forests in the Panjab, came home on furlough, and the Government of India intrusted him with the preparation at Kew of this work, for which he had been collecting materials for several years. While officiating in 1860-61 for Dr Jameson as Superintendent of the Botanic Garden at Saharanpur and of the Government Tea Plantations in the North-West Provinces, and subsequently while Civil Surgeon at Bijnaur in Rohilkhand, he became familiar with the forest vegetation in the plains and in the Himalaya between the Jumna and Kali rivers. In 1864 he returned to the Panjab, where he had passed his first years of medical service, principally on the western frontier, and being then appointed to the charge of the forests in that province, he devoted the greater part of his time to the botanical exploration of the Panjab Himalaya, Kashmir, and the adjoining districts of Tibet, and to repeated careful examinations of the Rakhs and brushwood tracts in the plains west of the Jumna river, including the adjoining province of Sindh. He thus acquired an extensive knowledge of the forest vegetation of a large portion of North-West India, and the copious notes taken on the spot in all his travels contained a rich store of information. In order to enable him to include the forest vegetation of Oudh and the Central Provinces, a forest officer of the North-West Provinces, Mr Richard Thompson, who had formerly served under Dr Stewart at Saharanpur, was at his suggestion deputed to visit the principal forest tracts of those provinces; and the notes and collections made by that officer were sent to him at Kew. Dr Stewart's previous publications in various scientific journals, as well as the numerous and valuable official reports submitted by him as Conservator of Forests, and his excellent book on the "Useful Plants of the Panjab," fully warranted the expectation that, after the needful preparatory study at home, he would be equal to the important task intrusted to him. He accordingly devoted a large part of his furlough, from 1869 to 1871, to this work, and would doubtless have completed it in a satisfactory manner if his health had not given way. During the latter part of his residence in England, it was evident to his friends that his general health was impaired; and when the first sheets of his manuscript were printed, it was clear that the work, as prepared by him, would neither be a useful one, nor one creditable to himself. He returned to India in October 1872, and died from an affection of the brain at Dalhousie on the 5th July 1873. Under these circumstances, as I had, while in India, recommended that this task should be intrusted to Dr Stewart, and as I happened to be in England for the restoration of my health, I was directed in March 1872, by her Majesty's Secretary of State for India in Council, to complete the work for publication; and the past two years have been devoted to this duty.

The following materials, besides the published literature and official reports, have been at my disposal: 1. The rich collections of the Royal Herbarium, Museum, and Gardens at Kew. 2. Dr Stewart's manuscript, comprising the description of 444 species. 3. Mr Richard Thompson's notes, and a portion of the collections made by him. 4. The greater portion of my own herbarium, which was in charge of Mr Sulpiz Kurz at Calcutta, and which I sent for as soon as I received orders to undertake the work. 5. A small collection of plants made by me on a journey through Rajputana and the forest tracts of Guzerat in 1869-70, with my journal and notes. A large portion of the notes and journals relating to my other tours in North-West and Central India, and some of the botanical collections made on those tours, were unfortunately in India, and could not be made available for the preparation of this work.

My personal knowledge of the arboreous vegetation of the territory included in this Flora has been acquired during a series of tours of inspection in the forests of the Satpura range, Bijoragogarh, and Oudh, the Nepal Terai, Kamaon, Garhwal, Rohilkhand, Dehra Doon, Jaunsar, and Gorakhpur, in 1863; the Deodar forests of Kunawar, the outer hills and a portion of the plains of the Panjab, in 1864; Kangra, the plantations and Rakhs of the Panjab, Sindh, Berar, and the western part of the Satpura range, in 1868-69; Kunawar, Rajputana, the Panch Mehal and Mandevi forests of Guzerat, and the Rakhs and plantations of the Panjab plains, in 1869-70; and during a residence of six summer seasons at Simla, and numerous excursions and smaller tours in the vicinity of that place. Unfortunately, I was never able, owing to continued pressure of official duties, to devote much time during those journeys to botanical studies. With the Flora of Tibet, Chamba, Kashmir, Kaghan, and the trans-Indus territory, I have no personal acquaintance.

The identification and description of species, and the botanical part generally, is entirely mine, and the result of my independent researches. I am alone responsible for them. But Dr Stewart's MSS. furnished me with much useful information regarding the vegetation of those districts, with which he was personally acquainted. In numerous cases they supplied data concerning the geographical distribution of plants, which I could not have obtained from any other source; and I invariably consulted them regarding vernacular names, the habit, mode of growth, and products of the trees. Where I had no personal knowledge of the plant —as, for instance, *Chamærops Ritchieana*, *Reptonia*, *Parrotia*, and other exclusively western trees—I have for the general remarks mainly relied on his manuscripts. For the trees and shrubs of those districts with which he was not acquainted, the work has been based upon other sources of information. With regard to the Panjab, I could not have completed this handbook without the assistance of Dr Stewart's manuscript, unless I had returned to India and devoted several years to a botanical exploration of the same ground where he had collected his information.

I have utilised the materials collected by my late colleague as far as they were embodied in his manuscripts, and in his various publications and official reports. Many months have we spent together in the fierce heat of the Kamaon Doons, in the Deodar forests of Kunawar near the limits of arboreous vegetation, and in other districts of North-West India. We have shared many a hard day's work, and have keenly discussed many botanical questions. It is a melancholy satisfaction to me to record the extent and value of his labours. Three new species were described in Dr Stewart's manuscripts: *Acer pentapomicum*, *Rhus punjabensis*, and *Adenanthera Oudhensis*—the two former discovered by him in the N.W. Himalaya, and the third by Mr Richard Thompson in the Oudh forests. These species have been accepted by me as defined and named by him; and at the end of this volume, an analytical key to the chief arboreous conifers of the N.W. Himalaya, by Dr Stewart, will also be found. Regarding the limitation of certain species, I have formed views differing considerably from those of Dr Stewart. This divergence of opinion mainly relates to the following genera: *Grewia*, *Zizyphus*, *Rhus*, *Acacia*, *Embelia*, *Diospyros*, *Olea*, *Ehretia*, and the *Bamboos*. I wished to have placed the views Dr Stewart entertained regarding those species before Indian botanists in his own words, but the state of his manuscripts prevented the adoption of this course. They are, however, deposited in the Library of the Royal Herbarium, Kew, and are available to those interested in the arboreous vegetation of North India.

A list of Dr Stewart's publications bearing on the subject of this book will be found at p. xx.

I have constantly consulted Jacquemont's Voyage dans l'Inde; Hoffmeister's Travels; Dr Hooker's admirable Himalayan Journals; Dr T. Thomson's clear and accurate description of the North-West Himalaya and its vegetation; Madden's excellent papers on the Terai and outer mountains of Kamaon; Edgeworth's valuable papers on the vegetation of Banda, Multan, and the North-Eastern Panjab; Aitchison's Flora of Jhelam and Catalogue of Panjab Plants; Cleghorn's full and instructive Report on the Forests of Panjab and the Western Himalaya; and the late Dr Stocks's contributions to the botany of Sindh.

I have now to acknowledge the kind and ready assistance which I have received on all sides in this undertaking. I value highly the privilege of having worked at Kew during the past two years. The free use of the Library and Herbarium, with its matchless collections of Indian plants, and its perfect order and arrangement, greatly facilitated my task; and the ready access at all times to the Gardens and the Museum of Economic Botany, enabled me to come to definite conclusions on many difficult questions. I am under the greatest obligation for the interest which Dr Hooker has from the commencement evinced in this work, and his advice and assistance given without reserve. Professor Oliver, the Keeper of the Herbarium, and in his absence Mr J. G. Baker, have examined the botanical part; and to Professor Oliver particularly I am indebted for corrections and useful suggestions as it passed through the press. Mr Bentham kindly permitted me to consult him on doubtful points. In my early days I had the privilege of studying under eminent botanists. I am proud to state that Schouw at Copenhagen, Treviranus at Bonn, Grisebach and Lantzius-Beninga at Göttingen, were my instructors; and I had the good fortune to accompany Link on some of his excursions in Greece, where I began my botanical pursuits under Dr Fraas, then Professor of Botany at Athens. Continuous official work in the Indian forest service since 1855 had compelled me almost entirely to abandon scientific pursuits, and I regard it as no small advantage to have been permitted to resume botanical research under the guidance of the first botanists in England.

To Mr Kurz, Curator of the Herbarium of the Calcutta Gardens, I am indebted for valuable notes, some of which are included under Addenda. Dr Rost, Librarian at the India Office, has with great kindness verified the Sanskrit, Arabic, and Persian names. Mr D. Hanbury has favoured me with useful suggestions regarding medicinal plants; and Dr Cleghorn, formerly associated with me in India, has from the commencement of the work given me the advice and counsel of a true and faithful friend—without his corrections I could not have ventured to publish this book in a language which is not my own, and without his devoted assistance at the last I could not have completed it.

D. BRANDIS.

KEW, *March* 1874.

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ABBREVIATIONS.

C.S.	Cold Season	Dec.	Jan.	Feb.
H.S.	Hot „	March,	Apr.	May.
R.S.	Rainy „	June,	July,	Aug.
	Autumn.	Sept.	Oct.	Nov.
Pb.		Panjab.		
N.W.P.		North-Western Provinces.		
C.P.		Central Provinces.		

Note.—For a full account of the climatic regions of India, see "Distribution of Forests in India," in Ocean Highways for October 1872, and Transactions of Scottish Arboricultural Society, vii. 88 (1873).

Eastern India. (Sikkim to Burma, including Bengal.)
North-West India. (Sindh, Panjab, N.W.P., Bandelkhand, and Rajputana.)
South India. (The Peninsula, south of the Satpura range.)

EXPLANATION OF TERMS.

Acuminate, terminating in a tapering point.
Æstivation, applied to the relative position of the parts of the calyx and corolla in bud.
Arillus, a dilatation from the funicle or placenta more or less covering the seed as it matures.
Arrested (as applied to the *axis*), when the internodes are undeveloped.
Berry, a succulent indehiscent (syncarpous) fruit.
Caruncle, a thickening of the mouth of the ovule as the seed matures.
Convolute (in vernation), a leaf rolled longitudinally on itself.
Divaricate, spreading at a wide angle.
Flexuose, alternately bending from side to side.
Glabrate, becoming glabrous on full development.
Hyaline, translucent.
Interpetiolar (applied to stipules), between two petioles.
Intrapetiolar (applied to stipules), between the petiole and branch.
Moniliform, beaded, constricted at intervals.
Penicillate, tufted like a camel's hair brush.
Ruminate, interrupted in internal structure, usually applied to albumen.
Scrobiculate, marked with minute shallow depressions.
Strigose, covered with short stiff more or less appressed hairs.
Strophiole, an appendage of the testa of some seeds, usually on the raphe, but independent of the funicle and micropyle.
Thyrsus, a compact pyramidal panicle.
Trinerved, with 3 nerves distinct from the base.
Triplinerved, with 3 nerves more or less confluent near the base.
Viviparous, developing leafy shoots from the inflorescence.

SYNOPSIS OF NATURAL ORDERS.

The distinguishing characters are selected with special reference to the trees and shrubs described in this work: a few Orders not here described, but containing important Indian trees or shrubs, are added in brackets.

FIRST CLASS. DICOTYLEDONS.

Pith surrounded by concentric layers of wood and bark. Wood and bark separated in the growing stem by a continuous layer of soft cells (*cambium*), which is transformed into new wood on the outside of the wood-cylinder, and into new bark on the inside of the bark. Ultimate venation of the leaves usually irregularly reticulate. Embryo with two or more cotyledons. In germination the cotyledons are generally raised above ground, the radicle lengthens, forming a tap-root, which at a later period branches.

FIRST SUB-CLASS. ANGIOSPERMÆ.

The wood consists of wood-cells, vessels, and medullary rays. Parts of calyx, corolla, or perianth usually in fours or fives. Ovules in a closed ovary, fertilised by the pollen-tubes penetrating into the ovary through the opening or loose tissue of the stigma. Embryo with two cotyledons, with or without albumen.

I. **Polypetalæ.**—Flowers with both calyx and corolla, the latter of distinct petals.

A. **Thalamifloræ.**—Petals hypogynous.

1. *Dilleniaceæ*, p. 1. Leaves alternate, simple, with prominent lateral nerves. Sepals persistent. Stamens indefinite. Pistil usually of several distinct carpels. Embryo minute in fleshy albumen.

2. *Magnoliaceæ*, p. 3. Leaves alternate, simple; stipules conspicuous, commonly convolute. Sepals and petals conform in 2-7 whorls of three, imbricate, deciduous. Stamens indefinite. Numerous distinct carpels. Embryo minute in a fleshy, oily, uniform albumen.

3. *Anonaceæ*, p. 4. Leaves alternate, entire, without stipules. Sepals and petals in threes or multiples of three. Stamens indefinite. Carpels distinct in fruit (united in *Anona*). Embryo minute in a ruminated albumen.

4. *Menispermaceæ*, p. 7. Climbers with broad medullary rays and otherwise anomalous wood structure. Leaves alternate, simple, mostly palminerved, without stipules. Flowers unisexual, usually trimerous, sepals free. Stamens definite, often monadelphous. Fruit usually of several distinct one-seeded carpels. Embryo curved with or without albumen.

5. *Berberideæ*, p. 11. Leaves alternate. Sepals and petals usually trimerous, conform, caducous. Stamens mostly 6, free, opposite to petals; anthers opening by valves. Carpels one or several, distinct. Seeds albuminous.

6. *Capparideæ*, p. 13. Leaves alternate. Sepals 4. Petals 4. Stamens often indefinite. Ovary stipitate, syncarpous. Seeds numerous, attached to parietal placentas, generally without albumen.

7. *Bixineæ*, p. 16. Leaves alternate, simple. Sepals 4 or 5. Stamens indefinite; anthers bursting longitudinally by slits or pores at the apex. Ovary syncarpous, one-celled. Seeds generally few, on parietal placentas. Embryo with foliaceous cotyledons in a fleshy albumen.

8. *Pittosporeæ*, p. 19. Leaves alternate, simple, exstipulate. Flowers bisexual, regular, pentandrous and pentamerous. Sepals free. Ovary syncarpous. Embryo minute in a copious albumen.

9. *Tamariscineæ*, p. 20. Leaves alternate, small, generally scale-like. Flowers usually bisexual, regular, pentamerous, rarely tetramerous; stamens as many as petals, or twice that number. Ovary one-celled, syncarpous. Seeds numerous, tufted or winged.

[*Guttiferæ*. Resinous, often coloured juice. Leaves coriaceous, glabrous, opposite, undivided, penniveined. Flowers regular, generally unisexual. Sepals free. Stamens numerous. Ovary syncarpous. Seeds few, without albumen. Embryo fleshy, oily.—*Garcinia pictoria*, Roxb.; Bedd. Fl. Sylv. t. 87. *Xanthochymus pictorius*, Roxb.; ib. t. 88. *Calophyllum elatum*, Bedd.; ib. t. 2. (Poon); *Mesua Roxburghii*, Wight (*M. ferrea*, Roxb.)]

10. *Ternstrœmiaceæ*, p. 24. Leaves alternate, coriaceous, simple, penniveined. Flowers regular, usually pentamerous and bisexual. Sepals 5. Stamens numerous. Ovary syncarpous, 3-5-celled. Seeds generally few and exalbuminous. Embryo fleshy, oily.

11. *Dipterocarpeæ*, p. 26. Resinous. Leaves alternate, generally entire, penniveined. Flowers bisexual, pentamerous, regular. Calyx often adnate to ovary, and its segments enlarged in fruit. Stamens 5, 10, 15, or indefinite. Ovary syncarpous. Seeds one, rarely two. Embryo with thick fleshy cotyledons, albumen none.

12. *Malvaceæ*, p. 28. Wood soft and light. Leaves alternate, stipulate, simple, often palminerved, with stellate hairs. Calyx-lobes valvate. Stamens numerous, monadelphous; anthers 1-celled. Fruit a dehiscent capsule, or often separating ultimately into distinct carpels, rarely indehiscent.

13. *Sterculiaceæ*, p. 32. Wood soft. Leaves simple or digitate, usually alternate and stipulate. Calyx-lobes valvate. Stamens monadelphous or free; anthers 2-celled. Fruit a dehiscent capsule, or a whorl of distinct carpels.

14. *Tiliaceæ*, p. 36. Leaves alternate, simple, with deciduous stipules. Calyx-lobes valvate. Stamens indefinite, usually free; anthers 2-celled. Ovary syncarpous, 2-10-celled.

[*Lineæ*. Leaves alternate, entire, stipulate. Flowers bisexual, regular, 5- rarely 4-merous. Stamens as many as petals or double their number, connate at the base into a tube or ring. Disc of 5 or 10 glands, often inconspicuous. Seeds few.—*Erythroxylon indicum*, DC.; Bedd. Fl. Sylv. t. 81.]

15. *Malpighiaceæ*, p. 44. Climbers with opposite entire leaves. Flowers

regular, bisexual, pentamerous. Stamens 10. Fruit of 1-3 winged one-seeded carpels. Seed without albumen.

16. *Geraniaceæ*, p. 45 (*Averrhoa*). Leaves alternate, imparipinnate, without stipules. Sepals 5; petals 5; stamens 10. Fruit oblong, fleshy, 5-ribbed.

17. *Rutaceæ*, p. 46. Leaves compound or simple, usually alternate, without stipules, aromatic, dotted with translucent glands. Disc annular, thick. Flowers 4- or 5-merous. Stamens as many as petals, or twice that number, rarely indefinite.

18. *Simarubeæ*, p. 58. Bark bitter. Leaves usually alternate, compound, without stipules, not dotted with glands. Flowers small, generally unisexual, regular, 3-5-merous. Stamens as many as petals, or double their number.

19. *Ochnaceæ*, p. 60. Leaves alternate, simple, shining, coriaceous. Flowers regular, bisexual. Sepals 5; petals 5 or 10. Stamens 10 or indefinite; anthers linear. Fruit usually of 3-10 distinct, 1-seeded drupes.

20. *Burseraceæ*, p. 61. Balsamic or resinous. Leaves alternate, 3-foliolate or imparipinnate, without stipules. Stamens usually 8 or 10. Seeds one or few, without albumen.

21. *Meliaceæ*, p. 65. Leaves alternate, pinnate, without stipules. Flowers regular, bisexual, in large panicles. Stamens generally 8-10, monadelphous.

22. *Olacineæ*, p. 74. Leaves alternate, simple, exstipulate. Flowers small, 4-5-merous. Stamens as many as petals or twice their number. Fruit indehiscent, 1-seeded.

23. *Ilicineæ*, p. 75. Leaves evergreen, alternate, simple, glabrous. Petals 4-5; stamens as many as petals. Fruit a drupe with three or more 1-seeded pyrenes.

24. *Ampelideæ*, p. 97. Climbers. Leaves alternate, simple or compound. Calyx small; petals valvate in bud. Stamens opposite to petals. Fruit a berry with one or a few hard seeds.

25. *Sapindaceæ*, p. 103. Leaves alternate or opposite, simple or compound. Flowers polygamous, often irregular. Stamens usually more than petals, not double their number. Seeds few.

26. *Sabiaceæ*, p. 115. Leaves alternate, without stipules. Flowers tetramerous or pentamerous. Stamens opposite to petals. Anther-cells distinct. Seeds few, without albumen.

27. *Anacardiaceæ*, p. 117. Often resinous. Leaves various, without stipules. Fruit generally drupaceous, 1-celled, 1-seeded (2-5-seeded in *Spondias*).

[*Coriarieæ*. Leaves opposite, simple. Flowers bisexual, regular, pentamerous. Stamens 10. Disc none. Fruit of 5-8 distinct one-seeded carpels, enclosed in the persistent coriaceous or succulent petals.—*Coriaria nepalensis*, Wall. p. 128.]

28. *Moringeæ*, p. 129. Leaves alternate, 2- or 3-pinnate; leaflets caducous, with glands in the place of stipules. Flowers large, bisexual, pentamerous, panicled; petals unequal. Fertile stamens 5, opposite to petals, alternating with sterile stamens. Fruit a long 1-celled 3-valved pod.

[*Connaraceæ*. Leaves alternate, without stipules, pinnate, 3- or 1-foliolate; leaflets coriaceous, entire. Flowers generally bisexual, pentamerous. Stamens 5 or 10. Ovary of five distinct 1-celled, hirsute carpels, one or more of which only comes to maturity, forming a 1-seeded oblique capsule.—*Connarus pinnatus*, Linn.; Bedd. Fl. Sylv. Man. 82.]

B. Calycifloræ. Calyx gamosepalous, often adnate to ovary. Petals inserted on the calyx.

29. *Celastrineæ*, p. 77. Leaves simple, alternate or opposite, generally coriaceous; stipules none, minute or early deciduous. Calyx small; lobes imbri-

cate. Stamens 3-5, alternating with petals. Disc large, surrounding the base of the 3-5-celled ovary. Fruit a fleshy drupe, or a capsule dehiscing loculicidally, or 3 distinct carpels.

30. *Rhamneæ*, p. 84. Branchlets and stipules often spinescent. Leaves alternate, simple. Calyx-lobes valvate. Stamens opposite to petals. Disc annular, cupular, or coating the calyx-tube. Ovary 2-3-celled.

31. *Leguminosæ*, p. 130. Leaves alternate, stipulate, pinnate 3-foliolate or unifoliolate. Carpel 1, free. Fruit a 1-celled pod. Seeds generally without albumen ; cotyledons filled with starch, or oily.

32. *Rosaceæ*, p. 189. Leaves simple or compound, stipulate, usually alternate. Stamens numerous. Carpels solitary few or numerous, free or enclosed in and adherent to the calyx-tube. Seeds without albumen.

33. *Saxifrageæ*, p. 210. Leaves simple, alternate or opposite. Flowers regular, generally bisexual. Calyx free or adnate to ovary. Carpels 2 or more, usually syncarpous. Seeds small ; embryo minute, in a copious albumen.

34. *Hamamelideæ*, p. 215 (*Parrotia*). Leaves deciduous, alternate, crenate ; stipules large, deciduous. Flower-heads enclosed in large, membranous bracts.

35. *Rhizophoreæ*, p. 217. Leaves opposite, petiolate, coriaceous, entire ; stipules interpetiolar, early caducous. Calyx adnate to ovary, 4-14-lobed ; lobes valvate, coriaceous, persistent.

36. *Combretaceæ*, p. 220. Leaves simple, petiolate, entire ; no stipules. Calyx-tube adnate to ovary ; limb 4-5-cleft ; lobes valvate. Stamens as many as calyx-lobes, or twice the number. Fruit winged or angled, 1-celled, 1-seeded. No albumen ; cotyledons fleshy, oily.

37. *Myrtaceæ*, p. 230. Leaves simple, penninerved, generally entire, either alternate, or (more commonly) opposite, with translucent glands. Flowers regular, bisexual, 4-5-merous. Calyx-tube adnate to ovary ; limb often closed in bud, and bursting irregularly or coming off entire. Stamens indefinite ; anthers dehiscing longitudinally. Seeds generally numerous.

[*Melastomaceæ*. Leaves simple, with 3-9 basal nerves (in *Memecylon* penniveined). Flowers regular, bisexual, 4-5-merous. Calyx-tube more or less adnate to ovary ; lobes imbricate in bud. Stamens definite, as many as petals, or twice that number. Anthers basifixed, opening at the apex with two pores or short slits, connective often thick and appendiculate.—*Memecylon umbellatum*, Burm., Bedd. Fl. Sylv. t. 206—Syn. *M. tinctorium*, Wight Ill. t. 93.]

38. *Lythrarieæ*, p. 237. Leaves simple, entire, generally opposite ; no stipules. Calyx free, gamosepalous ; lobes valvate in bud. Stamens definite or indefinite ; anthers dehiscing longitudinally. Fruit generally a 2-many-celled capsule. Seeds numerous, without albumen.

39. *Samydaceæ*, p. 242 (*Casearia*). Leaves alternate, distichous, simple, often with translucent glands ; stipules small, deciduous. Flowers inconspicuous, axillary, fasciculate. Ovary free. Capsule 1-celled. Seeds numerous ; embryo straight, in a fleshy albumen.

40. *Passifloreæ*, p. 244 (*Carica*). Stem simple, with few branches, tufts of palminerved leaves at the ends of branches. Flowers unisexual. Fruit large, succulent. Seeds numerous, parietal ; embryo straight, in a fleshy albumen.

[*Datisceæ*. Leaves alternate, without stipules. Flowers dioicous, petals often wanting. Calyx 3-9-lobed. Ovary inferior, 1-celled, with as many placentas and styles as calyx-lobes. Seeds parietal, numerous, minute.—*Tetrameles nudiflora*, R. Brown, p. 245.]

41. *Cacteæ*, p. 245. Flat and articulate, or columnar, succulent stems with minute leaves. Flowers large, bisexual ; calyx adnate to ovary ; lobes numerous. Stamens indefinite ; filaments long, filiform. Fruit fleshy, with numerous seeds.

42. *Araliaceæ*, p. 247. Leaves alternate, simple or compound. Flowers

regular, umbellate, or capitate. Calyx adnate to ovary; limb short. Petals caducous. Seeds few; embryo minute in fleshy albumen.

43. *Cornaceæ*, p. 250. Leaves entire, without stipules. Calyx adnate to ovary. Fruit a berry or drupe, 1- or 2-celled, 1- or 2-seeded. Albumen fleshy; cotyledons thin, foliaceous.

II. **Gamopetalæ.** Flowers with calyx and corolla, the latter gamopetalous.

A. Ovary inferior.

44. *Caprifoliaceæ*, p. 254. Leaves opposite, simple or pinnate. Fruit a berry or drupe, 1- or many-seeded; embryo minute in copious fleshy albumen.

45. *Rubiaceæ*, p. 260. Leaves opposite or whorled; stipules interpetiolar or intrapetiolar. Stamens as many as corolla-lobes, alternating with them, and inserted in the tube. Albumen fleshy or horny.

[*Compositæ*. Leaves alternate or opposite. Flowers in involucrate heads. Calyx-limb a pappus of scales, hairs, or bristles, rarely none. Stamens 5; anthers connate in a tube. Ovary 1-celled, with one erect ovule. Style of fertile flowers 2-lobed.—*Vernonia*, *Blumea*.]

B. Ovary free (except *Mæsa* and *Styraceæ*).

46. *Ericaceæ*, p. 279 (*Andromeda*, *Rhododendron*). Leaves alternate, simple, without stipules. Anthers 2-celled, opening by terminal pores. Capsule 5-18-celled, with numerous minute seeds.

47. *Myrsineæ*, p. 282. Leaves alternate, simple, without stipules. Calyx free, rarely adhering to ovary. Fruit a fleshy or dry berry, or a drupe, 1- or few-seeded. Seeds albuminous.

48. *Sapotaceæ*, p. 288. Milky juice. Heartwood well defined, hard and heavy. Leaves alternate, entire, usually coriaceous, without stipules. Flowers bisexual. Stamens numerous, in 2-3 series, or as many as corolla-lobes, and opposite to them, often alternating with staminodes. Fruit a 1- or few-seeded berry; testa hard, shining.

49. *Ebenaceæ*, p. 294. Leaves alternate, rarely subopposite, entire, without stipules. Flowers usually polygamous. Fruit a few-seeded berry. Albumen cartilaginous.

50. *Styraceæ*, p. 298 (*Symplocos*). Leaves alternate, simple, without stipules. Calyx adnate to ovary. Fruit crowned by the calyx-lobes, 1-seeded. Embryo in the axis of a fleshy albumen.

51. *Oleineæ*, p. 301. Leaves opposite, entire or pinnate; no stipules. Stamens 2. Ovary 2-celled. Seeds few.

52. *Salvadoraceæ*, p. 314. Leaves opposite, entire, with minute stipules. Flowers small, regular, tetramerous. Stamens 4, alternating with corolla-lobes. Ovary 2-celled. Fruit a 1-seeded berry.

53. *Loganiaceæ*, p. 317 (*Strychnos*, *Buddleia*). Leaves opposite, connected by interpetiolar stipules or a raised line. Flowers regular, 4-5-merous. Seeds numerous, rarely few, albuminous.

54. *Apocyneæ*, p. 319. Juice often milky. Leaves opposite or whorled. Flowers regular, bisexual, pentamerous, pentandrous. Calyx divided to the base. Corolla-lobes contorted in bud, throat hairy inside, or closed with scales. Anthers free. Ovary of 2 distinct carpels, or 2-celled, rarely 1-celled. Seeds numerous, often with a tuft of hairs.

55. *Asclepiadeæ*, p. 329. Juice milky. Leaves opposite entire, without stipules. Flowers regular, pentamerous, pentandrous. Calyx divided to the base.

Anthers connate into a tube, enclosing the style. Ovary of 2 distinct carpels. Seeds numerous, with a tuft of hairs.

56. *Boragineæ*, p. 335. Leaves alternate, without stipules. Inflorescence cymose usually unilateral. Flowers regular, 4-6-merous, 4-6-androus. Calyx persistent; lobes 4-6, valvate in bud. Ovary 2- or 4-celled, often 2-4-lobed. Seeds solitary in each cell or lobe.

57. *Convolvulaceæ*, p. 341. Climbers. Leaves alternate, without stipules. Flowers large, regular, bisexual, pentamerous, pentandrous. Calyx of 5 distinct sepals, persistent, often enlarged in fruit. Ovary 2- or 4-celled. Seeds few.

58. *Solaneæ*, p. 345. Leaves alternate, without stipules. Flowers regular, bisexual, usually pentamerous and pentandrous. Calyx usually gamosepalous.

59. *Bignoniaceæ*, p. 346. Leaves opposite, usually compound, without stipules. Flowers bisexual, pentamerous, often irregular. Calyx gamosepalous. Stamens 2 or 4, rarely 5. Ovary 2-celled. Fruit often elongated. Seeds numerous, often winged, without albumen.

60. *Verbenaceæ*, p. 353. Leaves opposite, without stipules. Flowers irregular, 4-5-merous. Calyx gamosepalous, persistent, often enlarged in fruit. Stamens usually 4. Ovary 2- or 4-celled. Seeds few, solitary in each cell.

III. **Apetalæ** or **Incompletæ.** Flowers with a single perianth, consisting of distinct or connate leaves or scales, or without perianth (calyx, and corolla only in *Loranthaceæ* and in a few *Euphorbiaceous* genera).

[*Nyctagineæ.* Nodes tumid. Leaves usually opposite, unequal; no stipules. Flowers bisexual or (Pisonia) dioicous. Perianth tubular, campanulate or infundibuliform, coloured, base persistent, often hardened, enveloping the 1-seeded achene.—*Pisonia aculeata*, Linn.; Wight Ic. t. 1763-64; Bedd. Fl. Sylv. Man. p. 175. *Bougainvillea spectabilis*, Willd.]

[*Phytolacceæ.* Leaves alternate, entire. Flowers usually bisexual, regular. Perianth 4-5-partite, often coloured, imbricate in bud. Ovary a whorl of 1-celled more or less distinct carpels; fleshy in fruit in *Phytolacca.*—*P. acinosa*, Roxb.; *P. dioica*, L., p. 371.]

61. *Polygoneæ*, p. 371 (*Calligonum*, *Atraphaxis*). Leaves alternate, simple, with sheathing stipules. Flowers small. Perianth regular, 3-6-lobed or of 3-6 leaves. Ovary free. Fruit dry, 1-seeded, compressed, trigonous or tetragonous. Seed with farinaceous albumen.

62. *Laurineæ*, p. 373. Aromatic. Leaves alternate, usually entire and evergreen, without stipules. Perianth regular, deeply 6-cleft. Stamens normally 12, biseriate, but a portion of the stamens generally wanting. Fruit a 1-seeded berry or drupe. Albumen none; cotyledons fleshy, oily.

[*Myristicaceæ.* Leaves coriaceous, alternate, often distichous, entire, penninerved, without stipules. Flowers inconspicuous, dioicous. Perianth 2-4-generally 3-lobed, coriaceous, tubular or campanulate; lobes valvate in bud. Stamens 3-18, monadelphous; anthers extrorse. Capsule fleshy, 2-valved. Seed 1, enveloped in a fleshy laciniate, often aromatic, aril. Embryo minute, in a copious aromatic ruminated albumen.—*Myristica moschata*, L. (*Nutmeg*); *M. laurifolia*, H. f. & Th.; Bedd. Fl. Sylv. t. 267; *M. corticosa*, H. f. & Th.; ib. t. 271; and other species in the dense evergreen forests of Burma and the Western Ghats.]

63. *Thymelaceæ*, p. 384. Bark tenacious. Leaves alternate or opposite, entire, without stipules. Flowers regular, 4-5-merous, bisexual. Perianth gamophyllous. Stamens as many as, or twice the number of, perianth-lobes. Ovule pendulous, solitary. Fruit 1-seeded.

64. *Elæagneæ*, p. 387. Leaves lepidote, entire, alternate, without stipules. Ovule erect, solitary. Fruit indehiscent, 1-seeded, enclosed within the succulent persistent base of the perianth.

[*Proteaceæ.* Leaves usually alternate, coriaceous, persistent; no stipules. Flowers usually bisexual, massed together in heads, spikes, or panicles, with imbricate bracts, and often with a general involucre. Perianth of 4, more or less connate, coriaceous leaves. Ovary free, 1-celled. Seeds without albumen. —*Helicia robusta*, Wall.; Bedd. Fl. Sylv. t. 301.]

65. *Loranthaceæ*, p. 391. Parasitic. Leaves coriaceous, entire, usually opposite, often wanting. Ovary inferior, with a solitary erect ovule.

66. *Santalaceæ*, p. 398. Leaves alternate or opposite, entire, without stipules. Flowers regular, 3-4-merous, 3-4-androus; stamens opposite to lobes of perianth. Ovary inferior, 1-celled. Fruit 1-seeded. Seed albuminous.

67. *Urticaceæ*, p. 400. Leaves stipulate, alternate, rarely opposite. Flowers unisexual. Perianth generally 3-5-lobed. Ovary free, 1- rarely 2-celled. Fruit 1-seeded, many often united in one syncarpium.

68. *Plataneæ*, p. 434. Leaves alternate, palmatifid; stipules caducous. Flowers unisexual without perianth, intermingled with scaly bracteoles, collected in globose pendulous heads.

[*Casuarineæ.* Branches whorled, articulate. Leaves reduced to many-toothed sheaths at the nodes. Flowers monoicous or dioicous. Male flowers in catkins, monandrous, with 4 connate bracts, in the axils of sheaths. Female flowers in bracteate heads, without perianth. Fruit a globose head of woody bracts and bracteoles, each pair of bracts including a 1-seeded caryopsis.—*Casuarina equisetifolia*, Forst., p. 435.

69. *Euphorbiaceæ*, p. 436. Leaves alternate or opposite, usually stipulate. Flowers unisexual. Perianth various, sometimes a calyx and corolla, or wanting. Ovary free, generally 3-celled. Fruit 3-seeded, often 3-lobed. Seeds oily; cotyledons flat, in a fleshy albumen.

70. *Betulaceæ*, p. 457. Leaves alternate, simple, penniveined; stipules deciduous. Flowers monoicous in drooping catkins. Ovary free, compressed, 2-celled. Fruit 1-seeded.

71. *Salicineæ*, p. 461. Wood soft and light. Leaves alternate, simple, stipulate. Flowers dioicous in lateral catkins. Ovary free, 1-celled. Seeds numerous, minute, enclosed in long silky hair.

72. *Cupuliferæ*, p. 477. Leaves alternate, simple; stipules deciduous. Flowers monoicous. Ovary inferior, generally 2-3-celled. Albumen none; cotyledons thick, fleshy.

73. *Myricaceæ*, p. 495. Leaves alternate, often aromatic, without stipules. Flowers unisexual, in catkins or spikes. Ovary free. Fruit a 1-seeded nut, clothed with fleshy or waxy pericarp. Albumen none; cotyledons fleshy.

74. *Juglandeæ*, p. 496. Leaves alternate, pinnate, often aromatic, without stipules. Flowers monoicous, the male in catkins, the female solitary. Ovary inferior, 1-celled. Seed 1, oily, without albumen.

SECOND SUB-CLASS. **GYMNOSPERMÆ.**

The wood, excepting that of the first year, which encloses the pith, consists of wood-cells and medullary rays, and has usually no vessels. Flowers unisexual, without calyx, corolla, or perianth. Ovules (not enclosed in an ovary) fertilised by direct contact with the pollen. Embryo in copious albumen, often with more than 2 whorled cotyledons.

75. *Gnetaceæ*, p. 500. Stem and branches articulate at the nodes. Leaves opposite, or reduced to a short bidentate sheath. Flowers enclosed by sheathing bracts. Anthers 2-8, filaments connate into a fleshy column. Seeds 1 or 2, enclosed in the persistent, more or less succulent bracts. Cotyledons 2, foliaceous.

76. *Coniferæ*, p. 502. Branches often whorled, not articulate. Leaves alternate, usually acicular, often tufted. Male flowers in deciduous catkins, with antheriferous scales. Seeds at the base of carpellary scales, fleshy or more commonly woody, forming a cone. Cotyledons 2-15, whorled.

[*Cycadeæ*. Stem usually unbranched with a terminal crown of rigid pinnate leaves, and marked with the scars of fallen leaves. Pith large, often with scattered vascular bundles; medullary rays broad. Flowers dioicous in erect terminal or axillary cones. Antheriferous scales large, bearing on their under side numerous anther-cells. Scales of female cones peltate or pinnatifid, bearing the ovules on their edges. Cotyledons 2, unequal, the upper part remaining enclosed in the farinaceous albumen of the germinating seed.—*Cycas circinalis*, Linn.; Bedd. Fl. Sylv. Manual, 227.]

SECOND CLASS. **MONOCOTYLEDONS.**

Vascular bundles scattered in the cellular tissue of the stem, closely packed near the circumference and more sparse near the centre. Pith, wood, and bark not distinct, no continuous cambium layer, and no regular increase in thickness of the stem by the formation of concentric layers of new wood and bark. Leaves with sheaths or broad-based petioles, the blade usually with longitudinal nerves, with or without cross veins, but without irregularly reticulate venation. Perianth, where present, stamens, and usually carpels, in threes, or multiples of three. Embryo generally small, usually surrounded by copious albumen; cotyledon 1, partly remaining enclosed in the germinating seed. The radicle gives off fibres during germination, forming a fibrous root.

77. *Palmæ*, p. 541. Stem solid, usually unbranched, with a terminal crown of petiolate, pinnately or palmately divided, leaves. Calyx 3-fid. Corolla 3-petalous. Ovary 3-celled. Albumen horny, cartilaginous, or oily.

[*Pandaneæ*. Stem solid, dividing into dichotomous branches, each branch with a tuft of linear sheathing leaves in spiral rows. Flowers unisexual, without perianth, sessile in large heads or spikes. Ovary 1-celled. Albumen fleshy or horny.—*Pandanus odoratissimus*, Roxb.; *P. furcatus*, Roxb.]

78. *Gramineæ*, p. 560. Stems above ground hollow, jointed, often with fascicled branches at nodes. Leaves simple, entire, usually linear, on long split sheaths. Flowers usually bisexual, in the axils of distichous bracts (glumes), with inner, usually 2-nerved bracts (paleas). Perianth incomplete, of 2-3 membranous scales. Seed 1, pericarp closely adhering to testa. Albumen farinaceous.

REMARKS ON THE STRUCTURE OF WOOD.

The peculiar structure of the wood of Coniferous trees, Palms, and Bamboos, is sufficiently explained at pages 502, 541, and 561. In this place it is intended to draw attention to the character of the main classes of Dicotyledonous woods, so far as they can be distinguished under the lens without the aid of a microscope. The classification here suggested is not complete; it only applies to the trees mentioned under each class. Orders and genera with anomalous wood-structure, and climbers, are not included. The object of these remarks is to offer a few practical hints, which may induce Foresters and others, who have to deal with Indian timbers, to examine the structure of the different kinds.

First Class.—Pores equal in size and uniformly distributed, sometimes a narrow belt with few pores at the outer edge of the annual ring, or a narrow belt with more numerous pores at its inner edge.

A. Medullary rays narrow or fine, generally all of one width.

1. Annual rings distinct.—*Euonymus europœus*, *Zizyphus vulgaris*, *Acer campestre*, *A. dasycarpum*, *Æsculus*, *Schleichera trijuga*, *Odina Wodier*, *Pyrus*, *Mespilus*, *Cratægus*, *Eriobotrya*, *Careya arborea* (pores scanty, in oval groups of 3-6, uniformly distributed, a narrow belt of darker wood at each ring), *Punica Granatum*, *Cornus*, *Viburnum*, *Coffea*, *Diospyrus Lotus*, *Ligustrum vulgare*, *Cinnamomum Camphora* (pores large, in radial lines), *Elæagnus*, *Buxus*, *Betula*, *Salix* (*S. tetrasperma*, from Burma, however, has larger and more numerous pores in the spring wood, and *S. caprea* has a similar structure, but less marked), *Populus*, *Juglans regia*.

2. Annual rings more or less indistinct.—The division between this and the first group is uncertain, for the wood of the same kind often has the annual rings distinct when grown in dry places or at high elevations, while under other circumstances the zones of annual growth cannot be distinguished. *Bombax malabaricum* (pores large, numerous), *Capparis aphylla*, *Shorea robusta*, *Melia Azedarach*, *Mangifera indica*, *Terminalia tomentosa*, *Conocarpus acuminata*, *Eugenia Jambos*, *Lagerstrœmia parviflora* (pores large, numerous whitish wavy concentric bands, not annual rings), *Nauclea cordifolia*, *N. parvifolia* (pores fine, in radial lines between medullary rays), *Olea europœa*.

B. Medullary rays of two classes, broad and narrow, the broad rays very marked.

1. Annual rings distinct.—*Dillenia indica*, *Acer pseudoplatanus*, *Negundo*, *Staphylea pinnata*, *Platanus orientalis*, *Alnus nepalensis*, *A. glutinosa*, *Fagus sylvatica*, *Carpinus orientalis*, and *Betulus*.

2. Annual rings more or less indistinct.—To this section probably belong several species of *Dillenia* and *Carallia integerrima*.

SECOND CLASS.—Pores nearly equal in size, but not uniformly distributed, crowded in the spring wood and scanty in the autumn wood, annual rings always distinct. *Tamarix* (medullary rays broad), *Rhamnus catharticus, R. Frangula, R. Alaternus* (pores in wedge-shaped branching tails in most species of *Rhamnus*), *Prunus* (medullary rays fine or moderately broad, broad in *P. Mahaleb*), *Terminalia chebula* (a narrow belt of autumn wood without pores), *Hippophaë rhamnoides, Alnus incana.*

THIRD CLASS.—Pores unequal in size, large and numerous in the spring wood, smaller and scanty in the autumn wood; annual rings always distinct.

A. Medullary rays narrow or fine, generally all of one width. *Cedrela Toona* (annual rings marked by a single line of larger pores), *Rhus Cotinus, Fraxinus, Tectona grandis, Morus alba, Celtis australis* (medullary rays short, moderately broad, but uniform), *Ulmus montana, U. campestris* (the smaller pores of the autumn wood in narrow wavy bands), *U. effusa, Broussonetia papyrifera, Castanea vesca.*

B. Medullary rays of two classes, broad and narrow, the broad rays very marked.—*Ailanthus glandulosa, Quercus pedunculata, Q. sessiliflora, Q. Cerris* (the smaller pores of the autumn wood generally arranged in irregular tails).

Quercus Suber and *Q. Ilex* have a peculiar structure, fully described in Mathieu's Fl. For. 256 and 263. The pores are arranged in wavy radial lines or tails; in *Q. Ilex* they are fine and not crowded in a belt of spring wood, in *Q. Suber* they are large and more numerous at the inner edge of each annual ring, without, however, forming a porous belt. *Q. serrata* has broad medullary rays and middle-sized pores, and *Q. semecarpifolia* has fine and numerous medullary rays. The wood of the other Indian Oaks has not yet been sufficiently examined.

The wood of the Indian Leguminous trees merits special study. It is often marked by wavy concentric bands of lighter-coloured tissue, which must not be confused with annual rings. *Albizzia odoratissima, Lebbek, procera* and *stipulata*, have large pores uniformly distributed, the pores often in groups of 2 or 3, and always enclosed in a patch of more open tissue, consisting of wood-cells different from the mass of the wood. These patches are arranged in more or less concentric lines, having the appearance of wavy bands. The medullary rays are fine and numerous, and the annual rings are generally distinct. The structure of *Dalbergia Sissoo, Cassia Fistula, Xylia dolabriformis, Tamarindus indica,* and *Acacia Catechu*, is similar, but the wood of the two last-named trees has no distinct annual rings. In *Acacia arabica* the pores are often close together in the inner part of each annual ring, and scanty in the outer belt. *Pterocarpus indicus* (*Padouk*) has large scanty pores, more numerous and larger in the spring wood, the pores of the autumn wood joined by white wavy concentric lines; medullary rays numerous, very fine. *Sophora japonica, Robinia Pseudacacia* and *Gleditschia triacanthos*, have a porous belt of spring wood, the autumn wood being firmer, with few pores. Another group is marked by having the pores arranged in wavy, concentric, or oblique lines. *Cytisus Laburnum, C. alpinus,* and *Cercis Siliquastrum*, a small tree with cordate leaves and pink flowers of the Mediterranean region (cultivated at Kabul as *Arghawan*, J. L. Stewart), have a belt of larger pores in the spring wood, while those of the autumn wood are arranged in concentric and oblique wavy lines and patches. *Ulex europaeus*, the *common Furze*, has all pores in oblique belts, forming a network of rhomboid meshes. *Tamarindus indica* has a similar structure, but no distinctly marked annual rings.

FOREST FLORA

OF

NORTH-WEST AND CENTRAL INDIA.

ORDER I. DILLENIACEÆ.

TREES or shrubs, rarely herbs, not aromatic, with simple alternate leaves and dilated petioles, or more rarely with deciduous stipules. Sepals 5, persistent, imbricate. Petals hypogynous, 5 or 4, imbricate, deciduous. Stamens hypogynous, numerous, in many series. Anthers dehiscing longitudinally or by terminal pores. Carpels one or more, free, or cohering with the axis. Seeds solitary, few, or many, albuminous; albumen fleshy; embryo minute. In most genera, but not in *Dillenia*, the seeds are arillate.—Gen. Pl. i. 10; Royle Ill. 58; Wight Ill. i. 6.

1. DILLENIA, Linn.

Trees with large penniveined leaves, lateral nerves prominent; leaves generally approximate at the end of branches, leaving large scars when they fall. Flowers large, bisexual, solitary or fascicled, yellow or white. Petals 5. Anthers linear, bursting at the top by small slits or pores. Carpels 5 to 20, cohering in the axis; styles as many as ovaries, spreading. Fruit globose, enclosed in the thickened calyx.

Flowers white; seeds pilose	1. *D. indica.*
Flowers yellow; seeds glabrous.	
Flowers fascicled; leaves oblong-lanceolate . .	2. *D. pentagyna.*
Flowers solitary; leaves obovate	3. *D. aurea.*

1. **D. indica,** Linn.; Wight Ic. t. 823; Bedd. Fl. Sylv. t. 103; Hook. Fl. Ind. i. 36.—Syn. *D. speciosa,* Thunb.; Roxb. Fl. Ind. ii. 650; W. & A. Prodr. 5. Vern. *Chalta,* Beng.; *Mota Karmal,* Mahr.; *Thabyūben,* Burm.

Leaves oblong-lanceolate, 8-10 in. long, deeply and sharply serrate, with numerous parallel stout ribs ending in the points of the serratures, coriaceous, hard when old. Petioles 1-1½ in. long, channelled and sheathing. Flowers with the leaves, solitary, large, sometimes 9 in. across, odorous. Sepals concave, thick and fleshy, edge thin and membranous. Petals oblong, waved, white. Outer stamens erect, inner longer, recurved.

Ovaries 20. Fruit large, 3 to 4 in. diam., hard outside, fleshy inside, with numerous reniform seeds embedded in a pellucid, glutinous pulp.

Wild along the base of the Himalaya from Nepal to Assam, in Bengal, South India, Ceylon, Burma, and the Malayan Peninsula; cultivated in most parts of India. Evergreen; fl. June, July; fruit ripens Feb.

A middle-sized tree, with a short erect bulky trunk, branches spreading into a broad rounded shady head. Bark of the trunk and larger branches about ½ inch thick, coarse and brittle, internally reddish brown, outer surface grey, shining, rugose, with many small cracks and exfoliating scales.

Sapwood white; heartwood light brown or pinkish white, close- and smooth-grained, with numerous medullary rays close together, as many as 15 to 20 on the quarter-inch, and large distinct annual rings. Weight of cub. ft. 41-45 lb. Made into gunstocks and helves, and in some places used in the construction of houses and ships. The rough old leaves, like those of other species of D., are employed to polish ivory and horn; the fleshy leaves of the calyx, which surround the ripe fruit, have an agreeable acid taste, and are eaten raw or cooked in curries, or made into sherbet. A palatable jelly is made from them.

2. **D. pentagyna**, Roxb. Cor. Pl. t. 20; W. & A. Prodr. 5; Bedd. Fl. Sylv. t. 104; Hook. Fl. Ind. i. 38.—Syn. *D. augusta* and *D. pilosa*, Roxb. Fl. Ind. ii. 652. *Colbertia coromandeliana*, D.C. Vern. *Aggai*, Oudh; *Kallai*, C.P.; *Zimbyūn*, Burm.

Leaves oblong-lanceolate, decurrent into short sheathing petioles, very large, 1-2 ft. long, longer on shoots and young trees, denticulate, with numerous parallel ribs, silky-downy when young, smooth and shining when old. Flowers before the leaves, sweet-scented, on slender pedicels, in loose fascicles on tuberosities along 2- or 3-year old branches, about 1 inch across or less. Sepals ovate-obtuse. Petals oblong, yellow. Outer stamens erect, inner longer spreading. Ovaries 5. Fruit pendulous, size of a gooseberry, the fleshy leaves of the calyx enclosing 5 small capsules, which contain a soft transparent gluten. Seeds few.

Along base of Himalaya from Oudh to Assam. In Bengal, Central India, South India, and Burma. Sāl forests of Oudh, and the Central Provinces on low flat ground, not on the hills. Sheds its leaves in March and April, comes into flower soon afterwards. Fruit ripens in May.

A moderate-sized tree in North and Central India, with an erect trunk 4-5 ft. girth, and straggling long ascending branches, with drooping ends. A stately tree in the south. Bark of smaller branches grey, shining, subrugose, of the trunk about ½ inch thick, compact, brittle, internally red, externally grey or pale brown, smooth, but with shallow depressions of irregular shape, caused by the exfoliation of the outer layers.

Wood hard, fibrous, porous, tough and strong, heavy and durable. Not easy to work, apt to warp and crack. Weight 45-48 lb. Used for construction and shipbuilding, for rice-mills; the leaves are laid under grass thatch, and are used as plates. Flower-buds and young fruit have a pleasant acid flavour, are eaten, raw or cooked, in Oudh and Central Provinces; the ripe fruit also eaten.

3. **D. aurea**, Smith; Hook. Fl. Ind. i. 37.—Syn. *D. ornata*, Wall. Pl. As. Rar. t. 23. Vern. *Chamaggai*, Oudh; *Dheugr*, Nepal; *Byūben*, Burm.

Leaves on deep-channelled sheathing petioles, oblong or obovate, 9-15 in. long, remotely crenulate, the ends of the parallel side-ribs prominent; when young, softly hairy or rufous silky on both sides; when old, glabrous above and pubescent beneath. Flowers before the leaves, solitary, at the end of short lateral branchlets, with ovate bracts at base of peduncle, 2-3 in. across. Sepals oblong, obtuse, concave, fleshy, with thin ciliated margins, at last reflexed, with long silky hairs on the back. Petals yellow, obovate from a narrow base. Stamens numerous, the inner longer spreading or recurved. Ovaries 6-12. Fruit on thick pilose peduncle, enclosed by fleshy calyx, size of a small apple. Seeds several, glabrous in a viscid pulp.

Northern Oudh forests; Burma. Sheds its leaves in February; the new foliage begins to show in April, generally after the numerous fine golden flowers.

A small tree in Oudh, rarely over 2 ft. girth, and 20 ft. high; in Burma a large handsome tree. Bark of trunk about ½ inch thick, reddish, compact, internally viscid, externally whitish, ashy, or brown, *quasi* tesselated by longitudinal and transverse cracks into subquadrangular scales, which eventually exfoliate. Heart- and sap-wood not distinct, close and hard. Weight, 45 lb.

ORDER II. MAGNOLIACEÆ.

Trees or shrubs, often aromatic, with convolute deciduous stipules and alternate leaves. Flowers often large, trimerous. Sepals and petals usually similar, in 2-7 whorls of 3, imbricate, deciduous. Stamens numerous, free, inserted on the torus; anther-cells adnate to connective. Ovaries numerous, often spirally arranged on the elongated torus. Ovules 2 or more on the ventral suture. Seeds with an abundant albumen, and minute embryo.—Gen. Plant. i. 16; Royle Ill. 58; Wight Ill. i. 9.

1. MICHELIA, Linn.

Trees with shining leaves; buds enveloped in the convolute stipules. Flowers bisexual. Sepals and petals conform, 9 or more, in 3 or more series. Gynophore stalked. Filaments flat. Anthers introrsely adnate. Carpels numerous, spirally arranged on an elongated conical torus, each with 3 or more ovules. Fruit a loose spike of coriaceous, 2-valved, 1-12 seeded carpels; seeds with a fleshy outer testa.

1. **M. champaca,** Linn.—**Tab. I.**—Roxb. Fl. Ind. ii. 656; W. & A. Prodr. 6; Hook. Fl. Ind. i. 42.—Syn. *M. aurantiaca,* Wall. Pl. As. Rar. t. 147. *M. Doltsopa,* Ham.; Wall. Tent. Fl. Nep. t. 3. Sans. *Champaka.* Vern. *Chamba, Champa.*

Leaves petiolate, ovate-lanceolate, acuminate, 8-10 in. long, strongly reticulated, shining and glabrous above, pallid, more or less pubescent beneath when young, glabrate afterwards. Flowers axillary, each with a deciduous, coriaceous, cinereous bract. Sepals and petals 15-20, the outer obovate, the inner narrow-linear, yellow or orange, with dark longitudinal veins. Capsules sessile on an elongated stalk, orbicular or broadly oval, opening on the back in two thick valves, dark-coloured, with large white round specks. Seeds 1-12, oval, compressed, brown, about the size of a small pea.

Cultivated in the outer Himalaya as far as the Rāvi (up to 3000 ft., at Almorah to 5400 ft.), occasionally in Bandelkhand and the C.P.; on Mt. Aboo, commonly in Bengal and South India (3000-5000 ft.) Evergreen. Flowers appear at various seasons, chiefly about May; seeds ripen in Nov. and Dec.

A handsome tree, in favourable localities from 60 to 100 ft. high, with a straight trunk 7 to 9 ft. in girth, branches ascending and spreading, forming a close, shady, oval head. Bark of younger branchlets with callous whitish points on a yellowish ground, of the trunk and older branches about ½ inch thick, inside greyish or reddish brown, outside light cinereous. Sapwood whitish, heartwood glossy, olive or dark brown, often beautifully mottled, coarse-grained, brittle, with numerous fine medullary rays, more than 30 in the quarter-inch, and distinct annual rings; prized for furniture, polishes well; used in Kamaon and Nepal for housebuilding, in the Penins. for carriage-work, verandah posts, and made into drums. Planted at Hindoo shrines; flowers prized on account of their sweet scent.

ORDER III. ANONACEÆ.

Trees or shrubs, with alternate, simple, entire, exstipulate leaves. Flowers bisexual, rarely unisexual. Sepals 3, free or connate, usually valvate. Petals 6, hypogynous, biseriate, usually valvate in the following genera, the 3 inner sometimes wanting; deciduous. Stamens numerous; filaments short or none; anthers adnate, 2-celled, commonly extrorse. Ovaries usually numerous, 1-celled; style short or stigma sessile. Fruit of one or more 1- or many-seeded carpels, dry or succulent, often stalked, rarely united into a fleshy fruit (*Anona*). Seeds large, with a ruminate albumen; embryo small.—Gen. Plant. i. 20; Royle Ill. 59; Wight Ill. i. 15.

Petals not conform to sepals.	
Ripe carpels distinct, one-seeded	1. POLYALTHIA.
Ripe carpels confluent into a succulent many-seeded fruit	2. ANONA.
Outer petals conform with the sepals; carpels 1- many-seeded.	
Inner petals flat; ovules 1-4	3. MILIUSA.
Inner petals saccate at base; ovules numerous . . .	4. SACCOPETALUM.

1. POLYALTHIA, Blume.

Flowers usually bisexual. Sepals 3, short. Petals 6, longer than sepals. Stamens indefinite, short, cuneate, closely crowded on a convex torus, anther-cells concealed by the overlapping connectives. Ovaries numerous, terminating in short thick styles; ovules 1-2. Fruit consisting of one or numerous one-seeded carpels, dry or fleshy, on long stalks, inserted on the pubescent or tomentose torus.

Glabrous; leaves lanceolate, acuminate; flowers fascicled, petals equal	1. *P. longifolia.*
Pubescent; leaves oblong, obtuse or acute; flowers solitary; petals unequal, pubescent; stalks twice the length of berries . .	2. *P. suberosa.*
Pubescent; leaves oblong-lanceolate, acuminate; flowers solitary or 2-3; petals equal, thick, glabrous; stalks more than twice the length of berries	3. *P. cerasoides.*

1. **P. longifolia**, Benth. & H. f.; Hook. Fl. Ind. i. 62; Bedd. Fl.

Sylv. t. 38.—Syn. *Guatteria longifolia*, Wall.; W. & A. Prodr. 10; Wight Ic. t. 1. *Uvaria longifolia*, Lam.; Roxb. Fl. Ind. ii. 664. Sans. *Devadāru.* Vern. *Asok, Asokan, Debdari, Devidari.*

A large glabrous tree; leaves on short petioles, long-acuminate, undulate, 5 to 8 in. long, pellucid-dotted, glabrous, shining. Flowers numerous, yellow green, on long slender pedicels, umbellate on short, leafless, tuberculate branchlets. Sepals broad-ovate. Petals equal, linear-lanceolate from a broad base. Carpels ovoid, ¾ in. long, on stalks about ½ in. long.

Indigenous in Ceylon; commonly planted in avenues along roads in Bengal and South India; occasionally in North-West India, as far as Hushiarpur. A tall, handsome, shady tree, with a fine straight trunk, attaining a girth of 6 ft. and a height of 50 ft., with a close symmetrical head. Evergreen; flowers between February and May; the seed ripens in July and August. Wood whitish yellow, fairly close and even-grained. The cubic foot weighs between 30 and 40 lb.

2. **P. suberosa**, Benth. & Hook. f.; Hook. Fl. Ind. i. 65; Bedd. Ic. Pl. Ind. Or. t. 56.—Syn. *Uvaria suberosa*, Roxb.; Cor. Pl. t. 34; *Guatteria suberosa*, Dun.; W. & A. Prodr. 10. Vern. *Bara Chali*, Beng.

A shrub or small tree; leaves bifarious, nearly sessile, 2-5 in. long, oblong, obtuse or acute, glabrous, pubescent beneath when young. Flowers pubescent, small, greenish white, on long slender pedicels, with a linear bract below the middle, mostly solitary, rarely two, on short woody tubercles. Sepals small, triangular. Petals unequal, the three outer ovate, ¼ in. long, 2-3 times the length of sepals, the three inner oblong ½ in. long. Carpels dry, numerous, globular, size of a pea, on stalks about twice their length.

Oudh forests (not common), Bengal, South India. Evergreen; flowers throughout the year, but chiefly in April and May; the seed ripens in Feb. and March. A large shrub or small tree. Bark of trunk and branches often with a thick rough cork layer. Wood close, hard, tough, and durable, weighs about 40 lb. per cubic ft.

3. **P. cerasoides**, Benth. & Hook. fil.; Hook. Fl. Ind. i. 63; Bedd. Fl. Sylv. t. 1.—Syn. *Uvaria cerasoides*, Roxb. Corom. Pl. t. 33; Fl. Ind. ii. 666; *Guatteria cerasoides*, Dun.; W. & A. Prodr. 10. Vern. *Hoom*, Bombay.

A moderate-sized or large tree. Leaves distichous, short-petiolate, 4-7 in. long, oblong-lanceolate, acuminate, glabrous above, pubescent beneath, with long soft hairs; main lateral nerves 6-8 pair, prominent beneath, with shorter intermediate nerves. Flowers greenish white, on pedicels ½-1 in. long, solitary, or 2-3 on short, lateral, woody branchlets, occasionally with 1 or 2 small leaves. Sepals broad-ovate, acuminate, pubescent. Petals lanceolate, thick, glabrous, ½ in. long. Berries numerous, dark red, ¼ in. diam., stalks slender, ¾ in. long.

South India, Western Ghats, Behar. Flowers Feb. to May. Evergreen. Wood prized on the Western Ghats, where the *Hoom* is an important tree of the evergreen forests in the Sattara district.

2. **ANONA,** Linn.

Flowers bisexual. Sepals 3, small, valvate. Petals 3 or 6. Stamens indefinite, crowded round a hemispherical torus, top of connective ovoid, overtopping the cells. Carpels united into a large fleshy fruit, with numerous seeds embedded in a soft pulp.

1. **A. squamosa,** Linn.; Hook. Fl. Ind. i. 78; Bot. Mag. t. 3095. —*Custard-apple* (*Sweet-sop* or *Sugar-apple* in America). Vern. *Ata,* Bengal; *Sharīfa, behli,* North-West; *Sita phal,* Bandelkhand.

Leaves petiolate, oblong or oblong-lanceolate, 2-3 in. long, glaucous beneath, pellucid-dotted, with a peculiar heavy smell. Flowers solitary or in pairs, on pedicels as long as the flower, inserted on short, leafless, terminal or extra-axillary branchlets. Sepals triangular, acute, united at base. Petals, 3 exterior an inch long, lanceolate, triquetrous, thick and fleshy; 3 interior minute or wanting. Fruit large, from 2 to 4 inches across, yellowish green, embossed with prominent oblong, obtuse, adnate scales, filled with as many pulpy cells as there are united carpels, some abortive, the rest one-seeded, all radiating from the central conical torus, from which, when ripe, the pulp readily separates. Seeds oblong, deep brownish black, with a pale swelling at the hilum.

Indigenous in the West Indies, but completely domesticated over a great part of India; cultivated as far north as Gurdaspur in the Panjab. Almost wild in Central Provinces and Bandelkhand (near old forts), and in swamps near Burmdeo in the Kamaon Bhabar.

A shrub or small tree with an erect short trunk. Nearly evergreen in the Panjab; the new leaves appear about March. Flowers in the hot season; the fruit ripening from July to Oct. Chiefly valued for its fruit; seeds acrid, fatal to insects.

Other species cultivated in India: *Anona muricata,* L.; *Sour-sop; Anona reticulata,* L.; *Bullock's-heart* or *Custard-apple* of the West Indies.

3. **MILIUSA,** Leschenault.

Flowers bisexual or diœcious. Sepals 3, small. Petals 6, 3 outer minute, conform to the sepals, 3 inner much larger; æstivation valvate. Stamens loosely imbricated on a cylindrical torus; anthers extrorse, distinct, attached to a thick connective which scarcely overtops the cells. Ovaries numerous, style oblong; ovules one or two, rarely more.

1. **M. velutina,** H. f. & Th.—**Tab. II.**—Bedd. Fl. Sylv. t. 37; Bedd. Ic. Pl. Ind. Or. t. 87; Hook. Fl. Ind. i. 87.—Syn. *Uvaria villosa,* Roxb. Fl. Ind. ii. 664. Vern. *Gidar-rūkh, gwīya, goā-sāl, dom-sāl,* N.W.P.; *Bari Kāri, Kajrauta, Kharrei,* Oudh; *Kāri,* C.P.; *Thabutgyi,* Burm.

Young branches, leaves, and flowers densely tomentose. Leaves on short petioles, ovate or oblong with cordate base, softly tomentose or pubescent on both sides, softly ciliate, 3 to 6 inches long. Flowers greenish yellow, on slender pedicels 2-4 in. long, in lax 3- to 6-flowered racemes on peduncles ½-1 in. long. Sepals and 3 outer petals small, ovate; 3 inner petals three times their length, broad-ovate, outside densely tomentose, inside smooth, dark brown. Fruit consisting of a number of black dry berries, ½ in. long, 1- or 2-seeded, on short stalks.

Burma, Bengal, Orissa, Northern Circars, Central Provinces, Oudh. Along the base of the Himalaya to the Ganges, ascending to 1500 ft. Deciduous; bare of foliage for great part of the hot weather, the new leaves appearing in April. Flowers from March to May; the fruit ripens in June and July, remaining long on the tree.

A middle-sized tree, with an erect short trunk to 4 ft. girth; in Burma a large tree. Bark of trunk nearly 1 inch thick, rough with cracks, and tesselated in subquadrangular, thick, grey, exfoliating scales. Heart- and sap-wood not distinct, sulphur yellow when fresh, light brown when old, with shining, hard, medullary rays. The seasoned wood weighs from 40 to 50 lb. per cubic foot; easily worked and durable, but liable to warp; used for small beams, cart-poles, yokes, agricultural implements, spear-shafts, and oars.

4. **SACCOPETALUM,** Bennett.

Trees. Flowers bisexual. Sepals 3, small, valvate. Petals 6, valvate in 2 series; the 3 outer small, conform to the sepals; the inner much larger, saccate at the base, erect or conniving. Stamens loosely imbricate round a subglobose torus; anthers extrorse, distinct, adnate to a thick connective, which overtops the cells. Ovaries numerous, ovules 6 or more.

1. **S. tomentosum,** H. f. & Th.; Hook. Fl. Ind. i. 88.—Syn. *Uvaria tomentosa,* Roxb. Cor. Pl. t. 35; Fl. Ind. ii. 667; W. & A. Prodr. 8. Vern. *Karri,* Oudh; *Hoom,* Bombay.

A large tree. Young shoots clothed with soft silky tomentum. Leaves elliptic or ovate-oblong, 6-12 in. long, on short petioles barely ¼ in. long, pubescent beneath, nearly glabrous and somewhat rough above. Flowers greenish yellow with a broad streak of brown, in leaf-opposed or subterminal 2-4-flowered cymes, on short peduncles, ¼-½ in. long. Pedicels slender, 2-3 in. long. Sepals and outer petals nearly equal, lanceolate, ⅛ in. long, inner petals ovate-oblong, obtuse, ⅝ in. long. Flowers and pedicels clothed with soft silky down. Carpels purple, tomentose, 3 or more, globose, 1 in. diam., 3-4-seeded, on stalks ¼-½ in. long.

Oudh forests, Nepal Terai adjoining Oudh, Goruckpur, Behar, Orissa. Evergreen forests of the Western Ghats. Leaves are shed in March, turning orange yellow before falling, renewed April, flowers with the young leaves. Fruit June.

In Oudh attains 50 ft. with an erect short trunk, 5-6 ft. girth, often gnarled and knotty from lopping. Bark 1 in. thick, brown or black, cracked and furrowed. Wood yellow, like that of *Nauclea cordifolia;* cracks in seasoning; used (in Oudh) for huts and cattle-sheds; reckoned as a good timber on the Western Ghats, where it is called by the same name as *Polyalthia cerasoides,* which, however, has one-seeded berries. Leaves used as cattle-fodder.

S. longiflorum, Hf. & Th.; Hook. Fl. Ind. i. 88. Eastern Bengal. Has solitary flowers on short pedicels ¼ in. long, and long pointed petals 1⅜ in. long.

ORDER IV. MENISPERMACEÆ.

Climbing or twining, rarely erect shrubs. Leaves alternate, entire or lobed, usually palminerved, exstipulate. Flowers small, diœcious or polygamous. Sepals commonly 6, free, the outer 3 often minute. Petals commonly 6, or wanting. Male flowers: stamens commonly 6, opposite to petals, rarely fewer or more; anthers 2-4-celled, frequently extrorse or dehiscing laterally. Female flowers: carpels free, distinct, 3, rarely 1 or more than 3; ovules solitary. Ripe carpels generally drupaceous, the seed enclosed in the woody or coriaceous endocarp, usually curved or reniform, with or without albumen, the radicle pointing towards the scar of the style, which is often near the base of the fruit.—Gen. Pl. i. 30; Royle Ill. 61; Wight Ill. i. 19.

Sepals 6; anthers sessile on a stout central column; drupes subglobose on a stout 3-fid gynophore; style near the base; endocarp hard, woody . . . . 1. ANAMIRTA.
Sepals 6; stamens free; ovaries 3-12.
  Drupes with scar of style near the apex, anthers bilocular, dehiscing longitudinally . . . . 2. TINOSPORA.
  Drupes with scar of style near the base.
    Dry fruit circular, compressed, strongly tubercled, anthers 4-lobed, dehiscing transversely . . . . . . 3. COCCULUS.
    Dry fruit obovate-oblong, not tubercled, anthers 2-lobed, dehiscing longitudinally . . . . 4. TILIACORA.
Male flower: sepals 4, petals connate into a 4-lobed cup; stamens monadelphous; female flowers in the axils of large leafy bracts; drupes with scar of style near the base; dry fruit circular, strongly tubercled . . . . 5. CISSAMPELOS.

1. ANAMIRTA, Colebrooke.

1. **A. Cocculus,** W. & A. Prodr. 446.—Syn. *Menispermum Cocculus,* Linn.; Roxb. Fl. Ind. iii. 807. Vern. *Kakmāri.*

A glabrous climbing shrub, bark corky. Leaves coriaceous, cordate or ovate, blade 4-8 in. long, petiole 2-6 in. Flowers greenish, in long pendulous panicles. Sepals 6, with two small adpressed bracts; petals none. Anthers numerous, 2-celled, on the top of a thick central column. Carpels 3 on a stout trifid gynophore ¼ in. long. Drupes subglobose, ½ in. diam., black, glabrous. Seed globose, enclosing the intruded endocarp.

South India, Eastern Bengal, Oudh forests (R. Th., but I have not seen specimens). The Cocculus berries are bitter, used in India to intoxicate and poison fish, and in England to adulterate beer.

2. TINOSPORA, Miers.

1. **T. cordifolia,** Miers; Hook. Fl. Ind. i. 97.—Syn. *Cocculus cordifolius,* DC.; W. & A. Prodr. 12; Wight Ic. t. 485, 486. *Menispermum cordifolium,* Willd.; Roxb. Fl. Ind. iii. 811. Vern. *Batindu,* Pb.; *Gulwail,* Bombay.

A glabrous, climbing, succulent shrub, bark corky. Leaves cordate, acute or acuminate, blade 2-4 in. diam., petiole 1½-3 in. Flowers small yellow, in long slender racemes, male flowers fascicled, female flowers usually solitary. Sepals 6. Petals 6, half the length of sepals, wedge-shaped. Filaments 6, thick, clavate, the 2 anther-cells obliquely adnate to the top. Ovaries 3. Drupes 1-3, red, succulent, plane-convex, size of a small cherry, with glutinous pulp, scar of style near the top. Endocarp kidney-shaped, albumen ruminate.

Common in hedges in most parts of India. Fl. H.S.R.S. Long filiform roots from the branches. Used in native medicine. Sold in the bazaars as *Gilo*, Pb.; *Gulo*, Bombay; *Guluncha*, Bengal.

3. COCCULUS, DC.

Male flowers: sepals 6, biseriate; petals 6, shorter than sepals, concave, embracing the stamens; anthers terminal, subglobose. Female flowers: sepals and petals similar to those of male flowers, stamens sterile or none, carpels 3. Drupes circular, compressed, generally 3, scar of style on the inner side near the base, endocarp tuberculate, horseshoe-shaped.

A small tree; leaves lanceolate, glabrous; flowers in long axillary panicles	1. *C. laurifolius.*
A climbing shrub; leaves-glabrate, linear-oblong or trapezoid; flowers axillary, male sessile fascicled, female solitary short-pediculate	2. *C. Leæba.*
A climbing shrub; leaves villous, ovate-oblong, male flowers in short panicles, female 1-3 on short axillary panicles . .	3. *C. villosus.*

1. **C. laurifolius**, DC.; Hook. Fl. Ind. i. 101.—Syn. *Menispermum laurifolium*, Roxb. Fl. Ind. iii. 815. Vern. *Parura*, Pb.; *Tilpara, kikra, dāl chīni*, N.W.P.

Leaves lanceolate, 3-5 in. long, short-petiolate, entire, 3-nerved, coriaceous, shining, dark green when young, light green when old, paler beneath. Flowers numerous, small, in long branched panicles, axillary or in the axils of fallen leaves; axis of panicle frequently bearing 1 or 2 leaves.

Outer Himalaya from the Ravi to Nepal, ascending to 5000 ft. An erect shrub, often a considerable tree, with a short, erect, straight trunk, spreading branches, and fine shining bright-green foliage.

2. **C. Leæba**, DC.; Hook. Fl. Ind. i. 102.—Syn. *C. glaber*, W. & A. Prodr. 13. Vern. *Vallūr, illar, billar*, Pb.

A climbing shrub, often with a stem 3-4 ft. girth; branchlets pubescent. Leaves glabrate or glabrous, oblong or trapezoid, entire or lobed, $\frac{1}{2}$-$1\frac{1}{2}$ in. long. Male flowers on short pedicels, in axillary panicles; female flowers solitary, on slender axillary peduncles $\frac{1}{4}$ in. long. Drupe $\frac{1}{6}$ in. diam.

Dry and arid regions of India. Panjab, Sindh, Dekkan, Afghanistan, Arabia. Dry regions of Africa. Fl. throughout the year.

3. **C. villosus**, DC.; Hook. Fl. Ind. i. 101.—Syn. *Menispermum hirsutum*, Linn.; Roxb. Fl. Ind. i. 814. Vern. *Kārsāne*, Oudh.

A climbing undershrub; branchlets, leaves, and inflorescence villous with greyish tomentum. Leaves ovate or ovate-oblong, obtuse, often mucronate, 1-3 in. long. Male flowers in axillary panicles, 1-$1\frac{1}{2}$ in. long, often with 1 or 2 leaves. Female flowers 1-3 on axillary pedicels $\frac{1}{4}$-$\frac{1}{2}$ in. long. Drupes 1-3, dark purple, $\frac{1}{6}$ in. diam.

Common in the plains and lower hills of most parts of India. Tropical Africa. Fl. Feb., March. The juice of the ripe berries makes a durable bluish-purple ink. The leaves rubbed in water thicken into a green jelly. Roots and leaves used in native medicine.

4. TILIACORA, Colebrooke.

1. **T. racemosa,** Colebrooke; Hook. Fl. Ind. i. 99.—Syn. *Cocculus acuminatus,* W. & A. Prodr. 12. *Menispermum polycarpon,* Roxb. Fl. Ind. iii. 816. Vern. *Tiliakoru,* Beng.; *Karwant, karrauth, rangoe,* Oudh.

A large climber, with entire, coriaceous, glabrous, ovate, acuminate leaves, blade 3-6 in., petiole 1 in. long. Fl. yellow, diœcious or polygamous, in axillary raceme-like panicles 6-12 in. long, with branches 1 in. long, bearing either one female, or 3-7 male flowers. Sepals 6, in two series, the outer much smaller. Petals 6, minute. Stamens 6, ovaries 3-12, styles short. Drupes 3-12, compressed, obovoid, $\frac{1}{8}$ in. long, stalked, style-scar near the base, endocarp thin, crustaceous. Seed hooked, albumen oily, ruminate. Cotyledons linear, fleshy.

Oudh forests, Bengal, Orissa, Concan, Ceylon. Fl. most part of the year. Fruit ripe March. Evergreen, enveloping the tallest forest-trees in its dense dark-green foliage. The long flexible branches are used for thatching and basket-work.

5. CISSAMPELOS, Linn.

Mostly climbers with peltate leaves. Male flowers cymose, tetramerous, petals connate into a 4-lobed cup. Stamens monadelphous, anthers united into a peltate disc, dehiscing round the margin. Female flowers racemose, crowded in the axils of large leafy bracts; perigonium of 1 or 2 lateral scales. Carpel one with a short trifid or tridentate style. Drupe circular, style-scar near the base; endocarp horseshoe-shaped, compressed, tubercled on the back. Seed curved.

1. **C. Pareira,** Linn.; Hook. Fl. Ind. i. 103.—Syn. *C. convolvulacea,* Willd.; W. & A. Prodr. 14; Roxb. Fl. Ind. iii. 842. Vern. *Katori, parbik, pataki, tikri,* Pb.; *Dakh-nirbisi,* N.W.P.; *Harjewri,* Oudh.

A climbing undershrub, with a short stem, throwing out long herbaceous twining branches, generally covered with grey tomentum. Leaves peltate, broad-ovate or reniform. Male flowers in axillary usually branched, and corymbose racemes, with few small bracts. Female flowers on elongate, generally simple racemes, with numerous, broad, alternate, foliaceous bracts, and several 1-flowered pedicels in their axils.

Common in most parts of India, in the north-west, along the foot of the Himalaya, as far west as the Jhelum river, but not in the arid parts of the Panjab and Sindh. Fl. March-Oct. Leaves and root used medicinally. A plant of very wide distribution. Also in tropical America, where it yields the *Radix Pareiræ* of druggists, and in tropical Africa.

The structure of the wood of Menispermaceæ is remarkable, and differs in several respects from the wood of other dicotyledons. The vascular bundles of a young branch (which in most dicotyledons unite and form concentric rings of wood and liber) generally remain distinct in Menispermaceæ, and are separated by broad radial masses of cellular tissue, corresponding to the medullary rays of ordinary wood. After some time these original wood fascicles cease growing, and in the cortical cellular tissue exterior to the liber originates a second circle of bundles, similar to the first formed, excepting in the absence of spiral vessels. After these bundles have attained full development, they in turn cease to grow, and a third circle forms in the cellular tissue of the bark, and so on. There is great variety in the wood structure of the genera of this family.

ORDER V. BERBERIDEÆ.

Usually shrubby, sometimes climbing, glabrous plants. Leaves simple or compound, stipules rare. Sepals and petals free, hypogynous, very caducous, usually trimerous, 2-4-seriate. Stamens hypogynous, 4-6 (rarely 8), opposite the petals, anthers adnate, erect, dehiscing by 2 revolute or ascending valves or by lateral or dorsal slits. Carpels 1-3, rarely more, oblong, ovules usually indefinite. Seeds with a copious, dense albumen. —Gen. Pl. i. 40; Royle Ill. 62; Wight Ill. i. 22.

Erect shrubs; flowers bisexual; one carpel . . .	1. Berberis.
Climbing shrubs; flowers unisexual; carpels 3 . .	2. Holboellia.

1. BERBERIS, Linn.

Spiny shrubs with yellow wood, yellow flowers and fasciculate leaves, the leaves of elongate shoots often reduced to simple or 3-7-forked spines. Sepals 6, with 2-3 adpressed bracts, imbricate in 2 series. Petals 6, in 2 series, imbricate. Stamens 6, free, anther-cells opening by recurved valves. Stigma peltate, sessile, or on a short style. Fruit a berry with few seeds. Albumen fleshy, embryo straight.

Leaves simple, membranous or thinly coriaceous, not lacunose, serrate, serratures equal, cuspidate; stigma sessile . .	1. *B. vulgaris.*
Leaves simple, obovate or oblanceolate, coriaceous, not lacunose, entire, or with large spinescent serratures; flowers on compound racemes; stigma small, on a short style . . .	2. *B. aristata.*
Leaves simple, narrow, lanceolate or oblanceolate, coriaceous, not lacunose, entire or spinose-dentate; flowers pale, small, on corymbose racemes; style distinct	3. *B. Lycium.*
Leaves simple, obovate or orbicular, coriaceous, hard, lacunose, reticulate, entire; or with large, distant, spinescent teeth; flowers fasciculate or in short racemes; style distinct .	4. *B. asiatica.*
Leaves imparipinnate, leaflets 2-12 pair	5. *B. nepalensis.*

1. **B. vulgaris,** Linn.; Hook. Fl. Ind. i. 109; Hook. Stud. Fl. 13. —*Barberry.* Vern. *zirishk*, Pb.

An erect, spinous shrub. Leaves deciduous, membranous, or thinly coriaceous, serrate with equal spinulose teeth, generally fasciculate on short lateral branchlets, in the axil of a 3-7-forked, rarely simple spine, on a thick broad base. The leaves vary exceedingly from oblanceolate, cuneate, or obovate, to broadly ovate. Flowers in racemes, elongated or shortly corymbose, on the short leaf-bearing branchlets. Berry ovoid-oblong or ovoid, red or black when ripe, terminated by the broad sessile stigma.

Western Himalaya 8000-12,000 ft., eastward as far as Nepal, Western Tibet, Afghanistan, and Beluchistan, Europe, North and West Asia. Fl. March, April. The pleasantly acid berries of this and some of the following species are dried and imported from Afghanistan under the name of *zirishk-tursh* (*sour currants*).

B. Kunawarensis, Royle Ill. 64, may belong to this species.

2. **B. aristata**, DC.; Hook. Fl. Ind. i. 110.—Syn. *B. tinctoria*, Leschenault; W. & A. Prodr. 16; Wight Ill. t. 8. Vern. *Chitra*, *chotra*, *totar*, N.W.P. The following names probably apply to this and the two following species in the Panjab Himalaya: *Sūmlu*, *sīmlu*, *kemal*, *kemlū*, *kamla*, *kasmal*, *kammal*, *tūtrum*, *chītra*.

An erect, spinous shrub. Leaves more or less persistent, coriaceous, obovate or oblanceolate, entire, or with few, large, distant, spinescent teeth, fasciculate on very short lateral branchlets, in the axil of a trifid or simple spine with a broad base. Flowers in compound racemes, pedicels often fasciculate. Berries often thickly covered with glaucous bloom, cylindrical, tapering into a short style terminated by a small subglobose stigma.

Outer Himalaya 6000-10,000 ft., from the Sutlej to Bhutan. Mountains ot South India and Ceylon. Fl. May-April. Hardy in England. The root of this and the two following species (*dārhald*, *dārchob*), and the dried extract (*rasaut*, *rusot*, *rasut*), are used in native medicine, and highly prized in ophthalmia. The wood is used as fuel.

3. **B. Lycium**, Royle; Hook. Fl. Ind. i. 110.—Vern. *Kushmul*, N.-W.P.

A rigid, erect, spinous shrub; bark white. Leaves simple, narrow, lanceolate or oblanceolate, coriaceous, mucronate, generally entire, bright green above, glaucous beneath, with prominent, lax, reticulate veins, fasciculate on short tuberculate branchlets in the axils of trifid spines on a broad base. Flowers pale, small, on elongate racemes. Berries violet, ovoid; stigma capitate, on a distinct style.

Outer North-West Himalaya 3000-9000 ft., from Hazara to Garhwal. Fl. April. Chiefly employed in Sirmore and Garhwal for making *rusot* (Royle).

4. **B. asiatica**, Roxb. Fl. Ind. ii. 182; Hook. Fl. Ind. i. 110.

A stout, erect, spinous shrub; bark pale. Leaves simple, fasciculate, on short tuberculate branchlets, often ¼ in. long in the axils of short trifid spines, which are often wanting; obovate or orbicular, hard, coriaceous, white beneath, with strong reticulate venation, lacunose between the veins, subentire, or with large, distant, spinescent teeth. Flowers in short corymbose racemes. Berries large, ovoid or often subglobose, red or black, glaucous; stigma capitate on a distinct style.

Outer Himalaya 3000-7500 ft., Garhwal, Bhutan, Afghanistan. Parisnath in Behar. Fl. March, April. The berries are eaten.

5. **B. nepalensis**, Spreng.; Hook. Fl. Ind. i. 109.—Syn. *B. Leschenaultii*, Wall.; W. & A. Prodr. 16; Wight Icones t. 940; *Mahonia Nepalensis*, DC. Vern. *Amūdanda*, *chiror*, Pb.

An evergreen shrub 3-6 ft. high. Leaves coriaceous, shining, imparipinnate, from 6-18 inches long. Petiole stiff, articulate at the insertion of the leaflets, broad-sheathing at the base, with 2 subulate stipules. Leaflets 2-12 pair, ovate or lanceolate, often falcate, spinous-serrate; the near pair—the base—often smaller and suborbicular. Upper leaves reduced to sheathing bracts. Flowers on long erect racemes, several together near the ends of branches. Bracteoles coriaceous, oblong or broadly ovate. Berry oblong or globose, dark blue or purple.

Outer Himalayan ranges, 6000-8000 ft., from the Ravi to Bhutan, Khasia hills, Burma, and the Nilgherries. Bark soft, corky, wood yellow, with fine medullary rays and light-coloured blotches between. The fruit is eaten.

2. HOLBOELLIA, Wall.

1. **H. latifolia**, Wall. Tent. Fl. Nep. t. 16. Hook. Fl. Ind. i. 108.

A climbing shrub; stem with corky bark, wholly glabrous. Leaves 3-9-foliolate, leaflets 3-6 in. long, petiolulate, ovate-lanceolate or linear, acuminate. Flowers monœcious, in lateral sessile corymbs, purplish green, sweet-scented. Sepals 6, 2-seriate, the outer valvate. Petals 6, minute. Stamens 6. Ovaries 3; fruit of 1-3 many-seeded oblong berries 2-3 in. long.

Himalaya, Kamaon to Assam, ascending to 9000 ft. Khasia hills. Fl. April, May. *H. angustifolia*, Wall., ib. t. 17, is a variety with linear-lanceolate leaves.

ORDER VI. CAPPARIDEÆ.

Herbs, shrubs, or trees, with alternate leaves. Flowers, with rare exceptions, bisexual. Sepals 4, rarely 3 or 5, free or connate. Petals generally 4. Stamens almost always more than 4, often indefinite, hypogynous, inserted at the base of a long or short gynophore; anthers 2-celled, versatile, generally on long slender filaments. Ovary often stipitate, style short or stigma sessile. Ovules indefinite on 2-6 parietal placentas. Fruit syncarpous, either more or less fleshy, or a dry, mostly elongated, capsule. Seeds in most cases without albumen; embryo incurved; cotyledons convolute or folded, rarely plane.—Gen. Plant. i. 103; Royle Ill. 72; Wight Ill. i. 33.

Spinescent shrubs or small trees; leaves simple; petals not clawed, imbricate in bud	1. CAPPARIS.
An unarmed tree; leaves trifoliolate; petals long-clawed; open in bud	2. CRATÆVA.

1. CAPPARIS, Linn.

Shrubs, rarely trees, generally with stipular thorns, young parts often with caducous tomentum. Leaves simple. Sepals 4, usually free. Petals 4, sessile, imbricate. Stamens indefinite; filaments slender, filiform, inserted on the torus at the base of the long gynophore. Ovary stipitate, generally one-celled. Fruit stalked, with many seeds embedded in a soft or dry pulp.

Leaves linear, minute; older branches leafless; flowers brownish red	1. *C. aphylla.*
Leaves ovate or elliptic; flowers white or rose-coloured.	
Flowers solitary, large; fruit 1-3 in. long	2. *C. spinosa.*
Flowers 2-4, supra-axillary, large; fruit 1-1½ in. diam. . .	3. *C. horrida.*
Flowers corymbose, small; fruit ⅓ in. diam. . . .	4. *C. sepiaria.*

1. **C. aphylla**, Roth.—**Tab. III.**—W. & A. Prodr. 27; Hook. Fl. Ind. i. 174.—Syn. *Sodada decidua*, Forskal; *Capparis Sodada*, R. Br., Boissier Fl. Orient. i. 419. Vern. *Karīl*, *Kari*, Pb. N.W.P.; *Kiral*, Sindh; *Sodāda*, Arab.

Glabrous. Leaves on young shoots only, caducous, sessile, linear-subulate, mucronate, ⅛ in. long, occasionally spathulate, varying to ½ in. long; stipules thorny, nearly straight, brown. Flowers brownish red or scarlet, corymbose, corymbs nearly sessile. Sepals unequal; the anterior outer sepal larger and deeply concave. Petals ovate, longer than sepals, scarlet. Stamens 8-20; filaments long, filiform. Ovary on slender gynophore as long as stamens; style subulate. Fruit globose or ovoid, ½-⅔ in. diam.; red when ripe; on a gynophore 1 in. in length.

Common in dry places and on stony hills throughout the Panjab, Sindh, and Rajputana, Bandelkhand, the Central Provinces, Guzerat, the Dekkan, and occasionally as far south as Tinnevelly. Flourishes in the driest deserts of North-West India, frequently associated with *Prosopis spicigera* and the *Salvadoras*. Extends westward as far as Arabia, Egypt, and Nubia.

New leaves on young shoots Nov. to March. Fl. March, April, sometimes as late as June; the bushes often crowded with the conspicuous brilliant scarlet blossoms.

Generally a scrubby bush, but under favourable circumstances a small tree, rarely 20 ft. high, with a short, erect trunk, often 4-5 ft., rarely 7-8 ft. girth. Branches numerous, divaricating, forming a depressed subglobose crown of dark-green colour; branches occasionally flattened into horny ribbons. Roots immense, spreading deep and wide. The natural reproduction and propagation of this tree should be studied; it is stated that it has never been raised by hand from seed or cuttings. Bark of trunk ½ inch thick, dark grey, furrowed with deep irregular longitudinal and diagonal cracks.

Wood with more or less distinct annual rings, whitish or light yellow, close-even-grained, tough, weighs about 54 lb. per cubic foot, when seasoned. It is bitter, and is not touched by white ants. Used for small beams and rafters in roofs (in Sindh for the knees of boats), for oil-mills and agricultural implements. As fuel, it answers well for brick-burning; for locomotives, it must be mixed with other wood. Burns off quickly with much flame, and leaves much ash.

The flower-buds (*pasi*) are used as pickle in Sindh, the unripe fruit is cooked and eaten; both the ripe and unripe fruit are prepared with salt and pepper into a bitter-tasted pickle which is exported into Hindustan.

2. **C. spinosa**, Linn.; Hook. Fl. Ind. i. 173; Boissier Fl. Orient. i. 420.—Syn. *C. obovata*, Royle; Jacq. Voy. Bot. t. 21. *C. Murrayana*, Graham; Wight Ic. t. 379. *Caper plant.* Vern. *Kabbar*, Arab.; *Kabarra*, Afg.; *Kābra*, Tibet; *Kaur*, *kiāri*, *kakri*, *kander*, *taker*, *ber*, *barāri*, *bauri*, *bassar*, Pb.; *Kalvāri*, Sindh.

Glabrous, but the young parts frequently covered with a white yellowish or greenish, soft, and caducous tomentum; armed with recurved or nearly straight stipular spines. Leaves petiolate, broad-ovate or obovate, retuse or entire, mucronate, thick, glabrous or glabrate. Flowers large, 1-3 in. across, white, solitary, axillary, on a pedicel equal to or longer than the leaf. Sepals unequal, ovate, obtuse, concave. Petals obovate, unguiculate, undulate, longer than calyx, at first pure white, then pink and purplish-red as they fade. Stamens numerous, longer than petals; filaments slender, purple. Ovary on a slender filiform gynophore as long as stamens; nectariferous glands at the base of gynophore. Fruit oblong, 1-3 in. long, on a strong gynophore, bent downwards when ripe; opening irregularly by 3-4 valves, crimson inside. Seeds numerous, reniform. This species varies exceedingly in the size, shape, pubescence, and consistence of the leaves. One form (var. *galeata*) is found in Sindh, with glabrous, often glaucous, fleshy leaves; the anticous sepal very saccate. Another (var. *leucophylla*) is found in the lower Himalayan valleys, floccose all over with white pubescence.

Panjab, Sindh, Guzerat, Mahableshwar, N.W. Himalaya, ascending to 12,000 ft. in the inner arid valleys. South Europe, North Africa, Western Asia. Time of flowering varies according to locality and elevation. In the Peshawur valley and the trans-Indus territory, it flowers from April to July, the fruit ripening about Nov.; in the inner Himalaya flowers from June to Oct.

A small trailing shrub on hot dry rocks and stony hills, with long green branches, a thick woody root, penetrating deep into the clefts of the rock. Strikingly handsome with its large flowers, long purple stamens, and the long-stalked ovary protruding from among them.

The flower-buds pickled are the capers of Europe, and might be prepared in India. The fruit is pickled and eaten in Sindh and the Panjab salt range. The leaves and ripe fruit are a favourite food of goats and sheep.

3. **C. horrida**, Linn. fil.; Wight Ic. t. 173; Hook. Fl. Ind. i. 178; W. & A. Prodr. 26.—Syn. *C. zeylanica*, Roxb. Fl. Ind. ii. 567. Vern. *Hīs*, *karvīla*, Pb.; *karralwa*, Oudh.

The entire plant when young covered with a dense ferruginous, caducous pubescence. Stipules laterally compressed, thorny, hooked. Leaves from elliptic-oblong to broadly ovate, mucronate. Pedicels supra-axillary, 2 to 4 in a vertical line, the uppermost flower opening first; flowers large, at first white, later rose-coloured. Stamens numerous, filaments long, filiform, purple. Gynophore as long as stamens. Fruit 1-1½ in. diam., globose or obovate, red when ripe, on a thick gynophore 1½ in. long.

Plains and lower hills in most parts of India, from the Panjab to Ceylon and Burma. Blooms from January or February to April; flowers often so numerous that the bush looks like a mass of white and rose colour. The fruit ripens after June, and remains on the plant for some time.

A scrambling shrub, found climbing at times to a great extent over the tallest trees. Wood used for fuel; the twigs, shoots, and leaves are greedily eaten by elephants and goats. In the Southern Panjab and Sindh the fruit is pickled.

4. **C. sepiaria**, Linn.; Roxb. Fl. Ind. ii. 568; W. & A. Prodr. 26; Hook. Fl. Ind. i. 177.—Vern. *Hiūn garna* (crooked Carissa), Panjab.

Young parts pubescent. Stipules thorny, hooked. Leaves ovate or elliptic, occasionally emarginate, glabrate above, pubescent beneath. Flowers small, ⅓ inch across, on filiform pedicels, in many-flowered corymbs. Sepals oval, concave. Petals oblong, white, unequal. Stamens much longer than petals. Fruit a globose berry ⅓ in. diam. on a short slender carpophore, one-seeded, black when ripe.

Here and there in the Panjab and the North-West. Common in the Peninsula, Burma, Ceylon, in the Andamans, Timor, and the Philippines. A middle-sized shrub, with numerous and strong branches, makes excellent hedges (Mysor, Coimbator), easily raised from seed or from cuttings. Flowers May; fruit ripens about July.

2. CRATÆVA, Linn.

Trees; leaves trifoliolate. Sepals and petals inserted on hemispherical disc. Sepals 4. Petals 4, long-clawed, open in bud. Stamens numerous, filaments slender, filiform, free. Ovary on a long gynophore, with 2 placentas bearing numerous ovules. Stigma sessile.

1. **C. religiosa**, Forst.; Bedd. Fl. Sylv. t. 116; Hook. Fl. Ind. i. 172. —Syn. *C. Roxburghii*, R. Br.; W. & A. Prodr. 23. *Capparis trifoliata*, Roxb. Fl. Ind. ii. 571. Sans. *Varana, varuna, setu.* Vern. *Brarna, Bilāsi, bila, biliāna.* (*Kadatben*, Burm.)

A moderate-sized tree. Leaves trifoliolate, clustered towards the ends of branches on common petioles 4 in. long, leaflets ovate-lanceolate, acuminate, on articulate petioles. Flowers large, 2 inches across, on long filiform pedicels, in many-flowered corymbs, with centripetal expansion. Sepals 4, ovate, deciduous, inserted with the petals on the broad-lobed hemispherical disc. Petals 4, long-clawed, larger than sepals, limb roundish ovate. Filaments longer than petals, inserted above the disc on the base of gynophore. Fruit ovoid or globose, about the size of an apple, on a strong thick gynophore, partially bilocular, owing to the cohesion of the placentas, with many reniform seeds ¼ in. long, nestling in a yellow pulp. Rind hard, subligneous, rough, with numerous whitish specks.

Subhimalayan tract, extending west to the Ravi, ascending to 2000 ft. Bandelkhand, Rajputana, South India, Assam, Burma, and Ceylon. Low and shady places, particularly near banks of rivers. Cultivated throughout India, in the north-west to the Jhelum river. Fl. April, May, when the tree has a striking appearance, with its large, cream-coloured blossoms. The old leaves at times remain on the tree till the flowers appear, but usually the tree is bare for some time. The young leaves appear with and after the flowers. Attains 30 to 40 ft. and a girth of 6 ft. Bark dark grey, even and smooth, with long horizontal wrinkles. Pith large; wood yellowish white, with sometimes a pinkish tinge, even, close- and smooth-grained. It is easy to work, fairly tough and durable, and not heavy. Used for drums, models, writing-boards, combs, boxes, and in turnery. In the Panjab the viscid pulp of the fruit is said to be mixed with mortar as a cement, and is also used as a mordant in dyeing.

ORDER VII. BIXINEÆ.

Trees or shrubs, with alternate simple leaves. Stipules minute or none. Flowers regular, uni- or bi-sexual. Stamens usually hypogynous, indefinite, rarely definite. Anthers 2-celled, bursting by slits or pores. Torus often glandular, or expanded into a disc. Ovary syncarpous, free, generally one-celled. Ovules parietal, generally numerous. Seeds with fleshy albumen; embryo axile, with broad foliaceous cotyledons.—Gen. Pl. i. 122; Royle Ill. 73; Wight Ill. i. 36, 38.

Flowers bisexual; petals large.
  Seeds covered with cotton; leaves palmate . . 1. COCHLOSPERMUM.
  Seeds naked; leaves entire . . . . 2. BIXA.
Flower diœcious; petals none.
  Ovary 2-8-celled; styles 2 or more. . . . 3. FLACOURTIA.
  Ovary 1-celled; style 1 . . . . 4. XYLOSMA.

1. COCHLOSPERMUM, Kunth.

Flowers bisexual. Sepals 5, deciduous. Petals 5, contorted in bud. Stamens indefinite, inserted on a disc without glands; anther-cells opening with a short slit at the top. Ovary with numerous ovules on 3 to 5 parietal placentas. Style one, filiform; stigma toothed. Capsules 3-5-valved. Seeds numerous, cochleate; testa hard, woolly; embryo curved.

1. **C. Gossypium,** DC.; W. & A. Prodr. 87; Hook. Fl. Ind. i. 190.—Syn. *Bombax gossypinum*, Linn.; Roxb. Fl. Ind. iii. 169. Vern. *Kūmbi*, N.W.P. *Gabdi*, Bandelkhand and Central Provinces.

A soft-wooded tree. Leaves alternate, large, near the ends of branches, on long thick petioles, palmately 5-lobed; lobes acuminate, grey-tomentose beneath; stipules linear, caducous. Flowers on terminal panicles, large, 3-4 in. across, bright yellow, rachis and pedicels covered with grey pubescence. Sepals broad-oval unequal, covered with a grey silky down, margin white-ciliate. Petals spreading, obovate, emarginate or irregularly cleft, with numerous parallel veins. Filaments filiform, shorter than petals; anthers linear, acuminate. Fruit in bunches, capsules oval, nearly the size of a goose-egg, 5-valved, divided by incomplete dissepiments. Seeds numerous, covered with a soft silky woolly substance.

Dry stony hills along the foot of the North-West Himalaya from the Sutlej to the Sardah, ascending to 3000 ft. Behar, Bandelkhand, Central Provinces, Dekkan and eastern districts of the Peninsula. Deciduous; the new leaves appear in May. Flowers from February to April; the fruit ripens in June and July. A small tree, with short thick spreading branches, the younger branches marked with great scars of the fallen leaves and fruit-stalks. Wood soft and light, not much used. A clear white gum (*Katīra*) exudes from the bark. Bellows for iron-smelting are made of the leaves.

2. BIXA, Linn.

Flowers bisexual. Sepals 5, imbricate, deciduous. Petals 5, large, contorted in the bud. Stamens indefinite, inserted on a thick torus below the ovary; anthers oblong, opening at the apex with two short slits. Style filiform; stigma minutely 2-lobed. Capsule coriaceous, one-celled, two-valved, with numerous seeds on parietal placentas along the middle of each valve. Seeds obovoid on a thick funicle, covered with a farinaceous red pulp; embryo large; cotyledons flat.

1. **B. Orellana,** Linn.; Wight Ill. t. 17; Roxb. Fl. Ind. ii. 581; W. & A. Prodr. 31; Hook. Fl. Ind. i. 190.—*Arnotto.* Vern. *Latkan.* (*Thūdin*, Burm.)

Young shoots and inflorescence rusty-puberulous. Leaves cordate, acuminate, entire or angular. Flowers in terminal panicles, large, 1-2 in. across, white or pink. Capsule ovoid, covered with long bristles.

Indigenous in America, but long cultivated in India. Flowers in summer; the fruit ripens in the cold season. A small tree with few branches, the leaves approximate at the end of the branches. The *Arnotto* (annotto) or pulp surrounding the seeds, is employed to tinge butter, and as a dye. Exported from Guiana, Brazil, and the West Indies.

3. FLACOURTIA, Commerson.

Flowers diœcious. Sepals 4-5, small, imbricate. Petals none. Male flowers with numerous stamens; anthers short, versatile. Female flowers with a 2-5-celled ovary on an annular, lobed disc. Styles 2 or more; stigmas notched or 2-lobed. Fruit a berry with few seeds, each surrounded by a distinct shell of hard woody endocarp. Cotyledons orbicular.

1. **F. Ramontchi**, L'Hérit.; Hook. Fl. Ind. i. 193; Wight Ic. t. 85. —Syn. *F. sapida*, Roxb. Pl. Cor. t. 69; W. & A. Prodr. 29; Roxb. Fl. Ind. iii. 835. Sans. *Swadu kantaka.* Vern. *Kūkai, kakoa, kangū, kandei*, Panjab; *Bilangra, bhanber, kandi, kattār*, N.W.P.; *Katti*, Oudh; *Kaikun*, Mairwarra; *Kānk, Kānki, bilāti*, C.P.

Armed; leaves alternate, shortly petiolate, varying much in shape, ovate-oblong ovate obovate or suborbicular, obtusely serrate or crenate, generally tomentose beneath, glabrous above. Flowers small, greenish yellow, in short racemes, or panicles with short side-branches. Styles 5-11, united at base. Fruit dark red or black, about ½ in. long. Seeds 8-16, generally in two layers, one above the other. This species, as defined in Flora Indica (1872), comprises the two old species *F. Ramontchi* and *sapida;* the forms vary extremely, and require further study. Very remarkable is a tomentose form (var. *occidentalis*) from Behar, the Dekkan, Oudh, Rohilkhand, and the Panjab.

Throughout India, mostly on dry rocky hills, and in open bare warm localities; cultivated in Bombay. The leaves fall in January and February, and the tree remains bare until the new foliage appears in spring, sometimes in March, but usually in May; the young leaves are first red, afterwards light green. Fl. from November-March, usually after the fall of the leaves; the fruit ripens May-June.

Generally a large shrub, but under favourable conditions grows into a moderate-sized tree, with a short trunk up to 4 and 5 ft. in girth, with straggling branches, generally thorny, the thorns being either terminal, forming the end of leaf-bearing branchlets, or axillary, being naked thorny branches without leaves. Bark of stem light or dark grey, or nearly black, somewhat rough, with exfoliating scales.

Sapwood and heartwood conform; close, fine, and even-grained; when dry, weighs about 50 lb. per cub. ft. Does not warp, is durable, and not attacked by insects. Combs are made of it; it is employed in turnery and for agricultural implements, and though not large, it is occasionally used for building. Young twigs and leaves are lopped for cattle-fodder. The fruit is eaten.

F. sepiaria, Roxb., a thorny shrub, thorns long, usually bearing fl. and fruit, has been found in Kamaon (Madden).

4. XYLOSMA, Forster.

Character of Flacourtia, but ovary 1-celled, with 2, rarely 3-6, few-ovuled parietal placentas; style one, short; stigma capitate. Fruit a small, globose, 2-8-seeded berry.

1. **X. longifolium**, Clos—**Tab. IV.**—Hook. Fl. Ind. i. 194.—Vern. *Chopra, chirūnda, chīrndi, drendu*, Pb.; *Kattāwa*, Oudh. *Dandāl, katāri, kandhāra*, N.W.P.

A moderate-sized tree, often armed with strong, straight, axillary spines 1 in. long or more. Leaves alternate, short-petioled, oblong-lanceolate, obtusely serrate, coriaceous, glabrous, shining, from 2-6 in. long. Flowers small, yellow, in short, axillary, glomerate panicles; pedicels bracteate; stigma indistinctly lobed. Berry ¼ in. diam.

Outer hills of the North-West Himalaya, ascending to 5000 ft. Also in Assam. Fl. Jan.-May. Wood used for fuel and charcoal. Fruit sweetish bitter.

ORDER VIII. PITTOSPOREÆ.

Trees or shrubs. Leaves alternate, simple, entire, exstipulate. Flowers usually bisexual. Sepals 5, imbricate. Petals 5, imbricate. Stamens hypogynous, 5, distinct, alternating with petals; anthers 2-celled, versatile. Ovary syncarpous, of 2 (rarely 3-5) carpels, with 2-5 parietal placentas; 1-celled or 2-5-celled by the projection of the placentas. Style one; stigma 2-5-lobed. Ovules many. Fruit capsular or indehiscent. Seeds usually numerous; albumen copious; embryo small, next the hilum. —Gen. Plant i. 130; Royle Ill. 77; Wight Ill. i. 172.

1. PITTOSPORUM, Banks.

Petals connivent or connate at the base or beyond the middle. Filaments subulate; anthers erect, introrse, dehiscing longitudinally. Ovary incompletely 2-3-celled. Capsule 1-celled, 2- rarely 3-valved, the placenta in the middle of each valve. Seeds smooth, embedded in a viscid pulp.

Leaves, young branches, and capsule glabrous . . 1. *P. floribundum.*
Leaves, young branches, and capsule tomentose . . 2. *P. eriocarpum.*

1. **P. floribundum**, W. & A. Prodr. 154; Hook. Fl. Ind. i. 199.—Syn. *Celastrus verticillata*, Roxb. Fl. Ind. i. 624. Vern. *Yekaddi*, Mahratti.

A small tree; leaves lanceolate or oblong-lanceolate, glabrous, shining, pale below, thinly coriaceous, 4-6 in. long. Flowers numerous, yellowish, in short, compact, terminal panicles. Petals free, linear-oblong, obtuse, patent, at last recurved. Capsules ¼ in. diam, glabrous, rugose, opening into two hard broad-ovate valves. Seeds 1-4, occasionally 8.

Outer Himalaya. Jumna to Sikkim, ascending to 3500 ft. (in Kamaon to 7000 ft.) Kasia hills. Western Ghats. Mostly on dry rocky sites. Fl. Jan.-June. Fr. April-Sept. A handsome tree, with a short, straight trunk and spreading branches. Bark of a greenish ash-colour, or yellowish grey, scabrous with small whitish specks. Wood light-coloured, strong and tough.

2. **P. eriocarpum**, Royle Ill. 77; Hook. Fl. Ind. i. 199.—Vern. *Meda tūmri, gar-silung, gar-shūna*, N.W.P.

A small tree with spreading branches; leaves, young branches, and inflorescence yellow-tomentose. Leaves ovate obovate or broad-lanceolate. Flowers numerous, in short terminal dense panicles. Petals free, linear, erect. Capsule ½ in. diam., tomentose, dividing into two broad ovate thick woody valves.

Outer Himalaya. Jumna to Sardah, between 3000 and 6500 ft. Fl. March, April. Fr. June, July. Bark dark grey.

ORDER IX. TAMARISCINEÆ.

Shrubs, rarely trees or herbs. Leaves alternate, small, often scale-like and imbricating. Stipules none. Flowers regular, usually bisexual, either solitary or in spikes racemes or panicles. Sepals 5, rarely 4, free or connate at the base, imbricate. Petals as many as sepals, imbricate, free or united in a tube. Stamens 5, 10, or numerous, inserted on an annular indented or lobed disc, with 10 glands; anthers versatile, with 2 cells, dehiscing longitudinally. Ovary syncarpous, of 3-5 carpels; ovules numerous, placentas 3-5, from the base of the cavity or attached to the carpels, sometimes enlarged so as to divide the ovary into cells. Capsule one-celled, dehiscent into 3-5 valves. Seeds either with a crest of long hairs at the apex, or winged, or covered with down all over. Albumen small or wanting; embryo straight.—Gen. Plant. i. 159; Royle Ill. 213; Wight Ill. i. 50.

Stamens free or connate at base only; styles 3-4 . .	1. TAMARIX.
Stamens monadelphous, stigma sessile	2. MYRICARIA.

1. TAMARIX, Linn.

Shrubs with scale-like or inconspicuous leaves. Flowers white or pink, in spikes or dense racemes. Sepals free. Petals free. Stamens 5-10, free or connate at base only. Ovary 1-celled, placentas short at the bottom of the ovary; styles 3 or 4 (rarely 2 or 5), short, thick. Seeds small, smooth, not beaked, with a long coma consisting of a setiform axis studded with long hairs; albumen none.

Leaves semi-amplexicaul; flowers in large panicles, composed of long slender spikes	1. *T. gallica.*
Leaves sheathing, apex of leaf erect or adpressed to branchlets.	
Branchlets continuous; flowers in close cylindrical spikes .	2. *T. dioica.*
Branchlets articulate; spikes interrupted	3. *T. articulata.*

1. **T. gallica**, L.—**Tab. V.**—Wight Ill. t. 24; W. & A. Prodr. 40; Hook. Fl. Ind. i. 248.—Syn. *T. indica*, Roxb. Fl. Ind. ii. 100. Sans. *Jhāvuka.* Vern. *Koān, rūkh, leinya, ghazlei, pūlchi*, Pb.; *Lei, lāi, jhau*, Sindh; *Yelta, rgelta*, Tibet; *Jhau*, Beng.

A shrub or small tree; leaves minute, apex patent or loosely adpressed, acute from a semi-amplexicaul base, not sheathing, glaucous, white-margined. Flowers mostly bisexual, pentamerous, generally white, rarely pink, crowded in long slender numerous spikes, collected into panicles at the ends of branches, and forming large irregular masses of flower; lateral spikes sessile or on short peduncles. Bracts shorter than flowers, semi-amplexicaul, membranous. Disc shallow, 10-crenate. Capsule attenuated from ovoid base, ⅛ in. long, when ripe more than twice the length of the withered sepals which enclose its base. Petals generally deciduous.

Throughout the Panjab and Sindh. In Tibet at 11,000 ft. Yarkand (Henderson), Bengal, the Peninsula, and Ceylon. This species has a wide range—it is found in Afghanistan, Persia, the countries round the Mediterranean, Africa, in Siberia, China, and Japan. In India, mostly on sand or gravel, along the banks of rivers and near the sea-coast; often on soil impregnated with salt; associated with Salvadora. Fl. July, August. Seed ripe Dec.-Feb. Grows moderately quick when young, the stems often attaining 10-12 in. girth in 10-12 years, but soon reaches maturity, and decays early, stems over 15 in. girth being generally hollow, especially in dry tracts with sandy soil. Easily propagated from seed and cuttings.

A shrub or small tree, attaining a girth of 3 and height of 30 ft. Stems crooked, dividing into numerous branches, which are more ramified than those of *T. dioica.* Branchlets feathery and often drooping. Bark of young branches reddish brown, smooth, with small whitish specks, that of stem and larger branches thin, greenish brown, rough with darker cross-lines. Foliage bright dark-green or glaucous. Flowers usually white in North India, pink in South Europe, Ladak, and Tibet.

Wood whitish, occasionally with a red tinge, open and coarse-grained, fairly hard and tough, but not strong. Medullary rays numerous, broad but short. Annual rings distinct. Its chief use is to supply fuel for steamers and otherwise; in Sindh and South Panjab agricultural implements are made of it, and it is used for turning and lacquered work.

It is with some diffidence that I follow Wight & Arnott in identifying this Tamarisk with *T. gallica*, Linn. But without further study of these variable shrubs on the spot, it appeared to me that I had no alternative. The figure in Sibthorp's Flora Græca, tab. 291, of *T. gallica*, seems to me to represent the ordinary form of the Indian species; but this is referred by Boissier, Fl. Orient. i. 773, to *T. Pallasii*, Desv., from Afghanistan, Beluchistan, and Bokhara, with smaller flowers, the disc deeply cleft into 5 emarginate lobes; petals persistent to the ripening of the capsule.

2. **T. dioica**, Roxb.—**Tab. VI.**—Roxb. Fl. Ind. ii. 101; W. & A. Prodr. 40; Hook. Fl. Ind. i. 249; Boissier Fl. Orient. i. 777.—Sans. *Pichula.* Vern. *Leinya*, *koān*, *kachlei*, *pilchi*, Pb.; *Gaz*, *lāo*, *jāu*, Sindh; *Lal Jhau*, Beng.

A shrub. Leaves minute, closely adpressed, sheathing, sheath tubular, apex deltoid, acuminate, green, with a broad white margin. Flowers diœcious, pentamerous, purple or light rose-tinged, in compact cylindrical spikes, either terminal or clustering at the ends of branches into loose racemose panicles; lateral spikes stalked. Bracts as long, or nearly as long as flowers, broad-ovate from a sheathing base, acuminate, membranous, reddish brown with white margin. Male flowers: stamens 5, inserted on the 5-lobed fleshy disc, alternate with the lobes; no rudiment of ovary. Female flowers: stamens abortive. Capsule oblong, tapering, ⅕ in. long, surrounded by the withered sepals and petals, and about twice their length.

Throughout Northern India, ascending to 2500 ft. in the Outer Himalaya. In the plains along the Jumna and Ganges, abundant on the Hooghly in Bengal, also on the Brahmaputra and in the Peninsula. Grows gregariously like *T.*

gallica, and forms extensive forests on the low, moist, alluvial lands along the Indus and its principal tributaries. The new formations of alluvial land along the banks of these rivers get covered in early spring with a dense mass of Tamarisk seedlings, mixed more or less with young plants of the *Populus euphratica* and *Acacia arabica.* It is believed that *T. dioica* is the principal species in these forests, and that *T. gallica* is less common. It is, however, a matter for further inquiry how far the distribution of these two species, and prevalence of one or the other, is affected by soil, locality, and other circumstances. *T. dioica*, like *gallica*, grows freely where the soil is impregnated with salt. Both species are often planted in gardens for ornament. Fl. from May-July; the seed ripens in the cold season.

These two species are easily confounded. *T. dioica*, however, is usually a very much smaller plant than *T. gallica.* A moderate-sized shrub, 6 or 7 ft. high, rarely attaining 15 ft., with little or no trunk, and numerous, virgate, long spreading branches, generally simple, their extremities bending down gracefully, especially when laden with flower. The twigs are reddish, brownish, or grey; the bark of the larger branches is dark grey or brown. The foliage is of a greyer green than that of *T. gallica.*

The wood is white with a pinkish tinge, loose- and open-grained, with numerous broad medullary rays. It is occasionally used for the supporting sticks of roofs, but mainly for fuel, like the preceding species. The Tamarisk forests are of great importance as sources of fuel, and the reproduction of these two species from coppice-shoots requires special study. It has hitherto been supposed that they coppice well under favourable circumstances; but recent experience seems to show that the power of reproduction from coppice-shoots of these species has been overestimated.

3. **T. articulata**, Vahl.—**Tab. VII.**—Hook. Fl. Ind. i. 249; Boissier Fl. Orient. i. 777.—Syn. *T. orientalis*, Forsk. Vern. *Frāsh, farās, farwa, rūkh, ūkhān, kharlei, narlei*, Pb.; *Asrelei*, Sindh.

A tree. Leaves minute, sheathing; branchlets apparently articulate at base of sheath; sheath thin, tightly adpressed, $\frac{1}{10}$ in. long, obliquely truncate, white-margined, with a triangular acute tooth in the place of the lamina; sheath and tooth covered with impressed-punctate glands, often hoary with saline efflorescence. Flowers bisexual or monœcious, pentamerous, loosely scattered on long slender spikes, generally clustering at the ends of branches into loose racemose panicles. Bracts triangular from a sheathing base, concave, acute, shorter than flowers. Disc indistinctly 5-lobed. Capsule oblong, tapering, surrounded by the persistent sepals and petals.

Panjab (ascending to 1200 ft.) Upper and Middle Sindh, eastwards to the Jumna. In Rohilkhand only cultivated. Beyond India, in Afghanistan, Persia, Arabia, North and Central Africa. Grows well on saline soils. The leaves and extremities of branchlets are shed (partly) during the cold season, the new shoots and leaves come out about May. Flowers from May to July, the fruit ripening later in the season. Growth rapid; trees 12 years old on an average attain a girth of 2-3 ft., one 15 years old measured 4 ft. 10 in. in girth, and it is stated that at times it attains 5 ft. in 7 years. Springs up freely from seed, and is readily propagated from cuttings. Coppices well.

In the Panjab it grows to be a moderate-sized tree, to 60 ft. high, with an erect trunk, often 6 or 7 ft. in girth, occasionally attaining 10-12 ft., tapering rapidly, with spreading branches, forming a close oval head. The slender twigs are frequently hoary with saline inflorescence; bark of branchlets smooth, reddish brown or light grey, that of the larger branches and upper part of stem dark bluish brown or dull grey, with a few dark brown scars and seams, that of the lower part of the stem light grey or brownish grey, and rough with many close deep longitudinal furrows and grooves, crossed by short shallow cracks. Except the very young shoots in spring, the foliage of *T. articulata* is much more grey and glaucous than that of the other species; this, with its arborescent habit, distinguishes it readily. There is a variety in the Panjab with adpressed and upright branches.

Sapwood distinct, heartwood whitish, open, coarse-grained, with conspicuous large white medullary rays. The weight varies from 40 to 60 lb. when seasoned, it is fairly strong and durable. Used for many kinds of ordinary work, made into ploughs, Persian wheels, and in Sindh is turned into small ornaments. The green wood burns with an offensive odour; when seasoned there is no smell, and it is then a good fuel.

The bark is employed for tanning; the small irregularly-rounded tuberculate galls (*Māi*, Panjab; *Sakun*, Sindh), often abundantly produced on the branchlets by the puncture of an insect, are used as a mordant in dyeing, and also in tanning. Similar galls are collected from the two other species, and sold under the same name. Tamarisk manna (*Misri lei*, sugar of Tamarisk) is produced on the twigs by the puncture of an insect, in parts of the Panjab and in Sindh. It is chiefly collected during the hot weather, and used medicinally or to adulterate sugar, will not keep more than a year, especially if exposed to damp. Manna is also produced by the two other species in Sindh, and by *T. gallica* in the Southern Panjab.

2. MYRICARIA, Desvaux.

Flowers bisexual, pink or white, in long racemes. Sepals 5, free. Petals free. Stamens commonly 10, inserted on the disc, and more or less united into a short tube. Ovary one-celled, with 3 sessile, more or less united, stigmata; ovules numerous, on short placentas at the bottom of the cavity. Seeds numerous, small, with a long coma.

1. **M. germanica,** Desv.—**Tab. VIII.**—Hook. Fl. Ind. i. 250; Boissier Fl. Orient. i. 763.—Syn. *M. bracteata*, Royle Ill. t. 44. Vern. *Bīs, shālakāt, kathi, hūmbu, hombu, umbu,* N.W. Himalaya.

A shrub; leaves sessile, linear-lanceolate, varying much in size, generally crowded, less than ½ in. long. Racemes terminal or lateral, up to 12 in. long; flowers pink, on short pedicels, crowded; bracts longer than pedicels, ovate-lanceolate, with broad membranous lacerated margins, caducous. Petals obovate, twice the length of sepals, white above, red below. Stamens shorter than petals; filaments united in tube. Seeds with a stalked coma.

Abundant in the inner, more arid parts of the Himalaya, from Iskardo to Sikkim, at elevations between 5000 and 10,000, ascending occasionally to 15,000 ft. Beyond India, in Afghanistan, Western and Northern Asia, and in the mountainous parts of Europe. Fl. July, Aug.; the seed ripens soon afterwards. Grows chiefly in sandy beds of streams, where it often covers considerable areas, becoming a shrub of considerable size, massed in clumps, peculiar and striking in its twiggy erect habit. A dwarf prostrate Alpine form grows at great elevations.

Young branches smooth, shining and striated; bark of trunk dark grey, fibrous and ragged. Foliage of a dull-greyish green colour, often covered by a saline efflorescence. The wood is small, and used as fuel; in Ladak the twigs are browsed by goats and sheep.

Nearly allied is *M. elegans*, Royle; Hook. Fl. Ind. i. 250; with white flowers and longer oblanceolate leaves, from Ladak, Zanskar, and Kunawar, where it is most valuable as yielding fuel, and often found associated with *M. germanica.* It attains a larger size; old gnarled trunks have 7-8 ft. in girth, with a rounded crown often 15-20 ft. high.

ORDER X. TERNSTRŒMIACEÆ.

Trees or shrubs, with alternate simple leaves. Stipules none, or very rarely minute. Flowers regular, bisexual, rarely unisexual. Sepals usually 5, imbricate. Petals usually 5, hypogynous, imbricate or twisted, frequently united into a short tube. Stamens usually numerous, hypogynous, the filaments often cohering at the base and united with the petals. Ovary plurilocular, ovules 2 or more in each cell, placentation axile; styles 2-7, distinct or more or less combined. Fruit 2-5-celled, coriaceous and indehiscent, or capsular and opening by valves. Albumen scanty or wanting; embryo frequently oily.—Gen. Pl. i. 177; Royle Ill. 107; Wight Ill. i. 89.

Flowers small, diœcious; sepals 5, nearly equal; anthers adnate; fruit dry, indehiscent	1. EURYA.
Flowers small, bisexual; sepals 5, nearly equal; anthers versatile; fruit indehiscent, dry or fleshy; leaves penniveined . . .	2. SAURAUJA.
Flowers large, bisexual; sepals 5-6, inner larger; anthers versatile; fruit a woody capsule, dehiscing longitudinally . . .	3. CAMELLIA.

1. EURYA, Thunberg.

Flowers diœcious. Sepals 5, strongly imbricate. Petals 5, imbricate, more or less united at the base. Stamens 12-15, attached to the base of the corolla in a single series; anthers adnate, opening longitudinally. Ovary mostly 3-celled; styles 3, distinct or united. Fruit a dry indehiscent berry. Seeds with a fleshy albumen.

1. **E. japonica,** Thunb.; Thwaites Enum. Pl. Zeyl. 41.—Syn. *E. Wightiana,* Wight Ill. t. 38; *E. acuminata,* Royle Ill. t. 24. Vern. *Bāunra, gonta, deura,* N.W.P.

A shrub 10-12 ft. high; leaves alternate, on short petioles, oblong-lanceolate, acuminate, obtusely serrate, coriaceous, glabrous or hairy when young, and underneath along the midrib. Flowers white, solitary or in fascicles, axillary, or from the axils of fallen leaves. Ovary ovoid; styles distinct, or united at the base. Fruit globose, $\frac{1}{6}$ in. diam., crowned by the persistent base of style.

Widely spread over Eastern Asia, in China, Japan, and Java. In India it is found on the mountainous regions of Burma, Ceylon, South India, Eastern Bengal, and the Outer Himalaya, alt. 3500-9000 ft., extending west as far as the Jumna, resembling somewhat the Tea plant. Fl. May-Sept. The specimens from the north-west are always hairy (extremities and midrib). In Burma, South India, and Ceylon, both the hairy and glabrous forms are found. In Hook. Fl. Ind. i. 284, the glabrous form with 2-flowered fascicles is referred to *E. japonica,* Thunb., and the hairy form with more numerous flowers to *E. acuminata,* DC.

2. SAURAUJA, Willd.

Leaves penniveined, with prominent parallel lateral nerves. Flowers bisexual. Sepals 5, strongly imbricate. Petals 5, imbricate, connate at base. Stamens numerous, adherent to base of corolla; anthers versatile, opening at the top by a pore or short slit. Ovary 3-5-celled; styles 3-5, distinct or united. Fruit 3-5-celled, indehiscent, dry or fleshy. Seeds small, immersed in pulp, with copious albumen.

1. **S. nepalensis**, DC.; Wall. Pl. As. rar. t. 178; Hook. Fl. Ind. i. 286. —Vern. *Gogīna*, *goganda*, N.W.P.

A large shrub; branchlets, young leaves, and inflorescence covered with stiff long brown hairs. Leaves on thick hirsute petioles, oblong, acuminate, 7-14 in. long, acutely serrate; lateral nerves prominent, 25-30 on each side of midrib. Flowers pink, in panicles, on a long common peduncle, axillary or from the axil of a fallen leaf. Styles 4 or 5, distinct, ¼ in. long.

Outer Himalaya, alt. 2500-7000 ft., from the Jumna to Bhutan. Fl. about May, the fruit ripening some weeks afterwards. The palatable viscid fruit is eaten.

3. CAMELLIA, Linn.

Trees or shrubs, with evergreen, coriaceous, serrate leaves, and large axillary bracteate flowers. Sepals 5-6, the inner larger. Petals cohering at the base. Stamens numerous, the outer in many series, more or less connate, and adhering to the base of the petals, the inner 5-12 free; anthers versatile. Ovary 3-5-celled, ovules 4-5 pendulous in each cell. Capsule woody, dehiscing longitudinally. Seeds large, oily, generally one in each cell; albumen 0; embryo straight; cotyledons thick, oily; radicle superior.

1. **C. Thea**, Link—Syn. *C. Bohea*, Griff. Not. iv. 553 (the China plant); *C. theifera*, Griff. l. c. 558 (the indigenous Assam plant); Hook. Fl. Ind. i. 292. *Thea chinensis*, Linn., The *Tea plant.*

A shrub, glabrous or slightly pubescent. Leaves elliptic, oblong, acuminate. Flowers solitary on short 2-3-bracteate peduncles. Sepals persistent, rotundate, very obtuse, glabrous or with silky pubescence. Petals white, obovate, obtuse, glabrous or pubescent on the back. Stamens glabrous, the inner 5 free. Ovary villous; styles 3, glabrous, connate beyond the middle. Capsule glabrous. Testa hard, smooth, shining.

Indigenous in Upper Assam (discovered 1834). Cultivated ages ago in China and Japan. Since 1840 cultivated extensively in Assam, Cachar, Sikkim, the North-West Himalaya, and other parts of India. The spread of Tea cultivation in North-West India is mainly due to Dr W. Jameson, who established the Government plantations in Dehra Doon, Kamaon, and Kangra. It was at one time supposed that there were two species in China, of which *Thea Bohea* yielded the black, and *T. viridis* the green Tea. These species, however, cannot be maintained. Though the varieties of the Tea plant are numerous, it is not at present possible to distinguish them by definite specific characters. The indigenous Assam plant is marked by larger, more acuminate leaves, and it is not certain whether it should not be regarded as a distinct species.

Camellia japonica, the well-known Camellia, is indigenous in Japan, and cultivated there as well as in China from time immemorial. Introduced into Europe in the beginning of the eighteenth century.

ORDER XI. DIPTEROCARPEÆ.

Trees (one genus of climbing shrubs), usually resinous, with alternate penniveined simple leaves. Flowers regular, bisexual. Calyx-tube campanulate, free or connate with the torus or ovary, 5-lobed; lobes imbricate, persistent and generally enlarged when the fruit ripens. Petals 5, twisted, united at the base, or free. Stamens free, either 10 or 5 in one series, or 15 in two series, or indefinite and multiseriate, inserted on the torus. Ovary sessile with a broad base on, or partly immersed in, the torus, 3-celled, rarely 1- or 2-celled. Fruit free, or enclosed in the enlarged calyx, with 1, rarely 2 seeds. Seed large, exalbuminous.—Gen. Pl. i. 189; Royle Ill. 105; Wight Ill. i. 85.

To this family belong the Wood-oil trees (*Dipterocarpus*) of Burma, the Indian Copal-tree (*Vateria Indica*) of the Western Ghats, and the Lac-tree (*Shorea laccifera*) of Mysore.

1. **SHOREA**, Roxb.

Calyx-tube short, adnate to torus, all segments enlarged into long wings when in fruit. Stamens indefinite (rarely 15), connective subulate, overtopping the anthers. Ovary 3-celled, ovules 2 in each cell. Fruit coriaceous, indehiscent, tightly enclosed by the base of the calyx-segments. Seed 1, ovoid; cotyledons fleshy.

1. **S. robusta**, Gærtn.—**Tab. IX.**—Roxb. Cor. Pl. t. 212; Fl. Ind. ii. 615; Bedd. Fl. Sylv. t. 4; Hook. Fl. Ind. i. 306. *The Sāl tree.*—Sans. *Sāla, asvakarna.* Vern. *Sāl, sāla, sālwa, sākhu, sāku, sakher.* Local names: *Sarye, sarei, rinjal, gūgal,* C.P.; *Koroh,* Oudh.

A large tree, young branches, petioles, young leaves and inflorescence hoary or pubescent. Leaves glabrate, shining when full grown, 4-8 in. long, petiolate, broad-ovate, from a rounded or cordate base, entire, more or less acuminate, ending in an obtuse point; stipules caducous. Flowers yellowish, shortly pedicellate, in unilateral racemes, arranged in long, compound axillary panicles; inflorescence, calyx, and outside of petals clothed with soft grey pubescence. Segments of calyx enlarged in fruit into 5 unequal, obtuse, oblong or spathulate wings 3-4 in. long, contracted above the base, brown, with 10-15 parallel longitudinal veins and fine reticulation between. Petals (at the time of flowering) 4 times the length of calyx, orange inside. Stamens 25-30 or more, anthers pilose at the apex, style subulate. Fruit ovoid, acuminate, ½ in. long, hoary.

The area at present occupied by the Sāl tree, forms two irregular, but fairly-defined belts, which are separated by the Gangetic plain. The northern or sub-Himalayan belt extends from Assam to the Kangra valley in the Panjab. Within these limits Sāl forms extensive forests, skirting the foot of the hills and entering into the Doons and valleys, ascending in places to 3000 ft. Near the western end of this belt the Sāl forests are less extensive, and they terminate near the Bias river in a number of scattered patches of limited area. West of the Ganges the Sāl is not found in the plains; but in Rohilkhand, Oudh, Gorakhpur, and Bengal, Sāl forests exist, or existed formerly, at a considerable distance from the hills. The second, or central Indian belt, occupies the hilly country of Behar, Rewah, Chota Nagpur, Midnapur, and the Meikal range of hills between the Nerbudda river and the open country of Raipur, and extends south to the Godavery river and the Northern Circars. The Pachmarri hills mark the western limit of the tree in this belt; the Sāl on the sandstone of these hills and in the Deinwah valley at their foot is an outlying and isolated patch of considerable extent, the last in that direction. The Sāl tree does not thrive on heavy binding soils; it requires a loose soil which transmits water freely. I have never found it on trap, and this probably explains its absence on the greater part of the Satpura Range in Central India. Sāl forests are generally found on sandstone, on conglomerate, the gravelly and shingly soil of the sub-Himalayan tract; and the tree attains perfection where loose water-transmitting soils are mixed with a large proportion of vegetable mould. Sāl is eminently gregarious. Wherever found, it is always the prevailing tree; a limited number of other species are associated with it, but they are always less numerous in individuals. The climatic conditions within the area occupied by the Sāl tree may, as far as known, be expressed as follows: A mean annual rainfall between 40 and 100 inches, and a mean temperature during the four seasons within the following limits—C. S., 55°-70°; H. S., 77°-85°; R.S., 80°-88°; Autumn, 74°-77°. As to extremes of cold, the Sāl can stand several degrees below freezing-point. I have seen the leaves frostbitten in the Kotridoon, and in Kangra and Hushiarpur it is exposed to severe cold. As to heat, it will suffice to say that during the hot season the extremes in the Kamaon Doons and the Deinwah valley are nearly as high as anywhere in India, but that the tree does not seem to stand the hot winds of the open plains in North-West India.

Sāl is never quite leafless: the young foliage issues in March, with the flowers; the seed ripens in June, and germinates immediately, often before falling. Large quantities of seed ripen, and an abundant crop of seedlings springs up annually, clothing the ground with a dense mass of young Sāl, to the exclusion of other trees. The circumstance that the seed ripens at the commencement of the rains, after the jungle-fires have passed through the forest, materially assists the reproduction and spread of Sāl. Other species of this family, particularly the *Ein tree* of Burma (*Dipterocarpus tuberculatus*, Roxb.), also produce a similarly abundant crop of seedlings, and form nearly pure forests of great extent. The Sāl tree coppices, but not under all circumstances. Regarding its rate of growth, our information is as yet incomplete. The annual rings in the wood are generally very indistinct; and the individuals, the age of which is known from other sources, are not numerous. For the Oudh forests (Kheree Division), the following was assumed as the mean rate of growth when the first regular plan for working them was framed in 1863:—

Age 15 years, girth 18 inches.
,, 50 ,, ,, 54 ,,
,, 80 ,, ,, 72 ,,

Subsequent data seemed to indicate a somewhat slower rate; and in 1868, Capt. Wood's estimate was 65 years for 54, and 95 years for 72 in. girth. The following cultivated trees of known age were measured by me in 1863:—

Saharanpur, 13 years, girth 27 inches (average of 33 trees).
,, 30 ,, ,, 54½ ,,
,, 35 ,, ,, 79½ ,,
Calcutta, 25 ,, ,, 69 ,,

Under favourable conditions—for instance, in the gorges at the foot of the hills in the Nepal Terai—the Sāl tree attains 100-150 ft., with a clear stem to the first branch of 60-80 ft., and a girth of 20-25 ft. But such dimensions are exceptional; as a rule, it attains 60-90 ft., with clear stems 30-40 ft. long, and a girth of 6-8 ft. Young trees have generally a long narrow conical head of foliage; in old trees the branches spread at the top. Of young trees the bark is moderately smooth, occasionally with a few long deep vertical cracks. The bark of old trees is 1-2 in. thick, dark-coloured and rough, with longitudinal furrows.

The wood of the Sāl tree has a distinct sapwood, small, about 1-2 in. thick, whitish, not durable. The heartwood is dark brown, coarse-grained, hard, heavy, strong, and tough, with a remarkably fibrous and cross-grained structure. The fibres of successive concentric strata do not run parallel, but at oblique angles to each other; so that when the wood is dressed, the fibres appear interlaced. Medullary rays numerous, narrow; pores very numerous, moderate, uniformly distributed. The weight of a cub. ft. (seasoned) is generally found to vary between 50 and 60 lb.; but extreme cases are on record of weights as low as 40, and as high as 69 lb. The transverse strength has been tested by numerous experiments. The average value of P (coefficient of transverse strength), as determined by Baker, Cunningham, Clifford, and others, ranges from 609 to 972; and in a large series of experiments with Sāl timber from different sources made by me in Calcutta in 1864 and 1865, with the assistance of Mr Clifford and Baboo Tincowry Ghose, the mean value of P was found to fluctuate between 708 and 916. Sāl timber takes a long time to season; and after it has been seasoned and worked up, it is apt to split and warp with the change of dry and wet seasons. Its durability is considerable, though not equal to that of Teak. In Lower Bengal it is liable to be eaten by white ants. For building, gun-carriages, river-boats, and railway-sleepers, it is the most important timber of North India. Sāl timber cannot be floated without the assistance of boats or floats of lighter woods. Semul (*Bombax malabaricum*) is often used for that purpose.

The tree, when tapped, exudes large quantities of a whitish, aromatic, transparent resin or dammar (*rāl*, *dhūna*), which is collected and sold; is used to caulk boats and ships, and also as incense. Large extents of Sāl forest have been destroyed by the practice of tapping the trees for this purpose.

ORDER XII. MALVACEÆ.

Herbs, shrubs, or trees, with a soft light wood; young parts mostly covered with stellate hairs. Leaves stipulate, alternate, generally palminerved. Flowers large, purple pink or yellow, regular, generally bisexual. Sepals generally 5, more or less connate, valvate in bud. Petals 5, hypogynous, usually adnate to staminal column, twisted and imbricate in bud. Stamens indefinite, monadelphous; anthers 1-celled, bursting lengthwise. Ovary syncarpous; carpels generally numerous, usually in one whorl round a conical torus. Fruit either a dehiscent capsule or a number of distinct carpels. Seeds solitary few or numerous, in most cases without albumen.—Gen. Pl. i. 195; Royle Ill. 83; Wight Ill. i. 55, 66 (Bombaceæ).

Bracteoles 4-6, enlarged in fruit, forming an epicalyx or involucel 1. KYDIA.
Bracteoles wanting.
  Fruit large, woody, filled with pulp . . . . . . 2. ADANSONIA.
  Capsule 5-valved, densely woolly inside . . . . . . 3. BOMBAX.

Hibiscus Rosa-Sinensis (*Shoe-flower*) from China, the Moluccas; *H. Sabdariffa* (*Roselle, Red Sorrel*), from the West Indies; *H. esculentus*, the edible Hibiscus (*Okra, Bendi*), from the West Indies; and *Gossypium herbaceum* (*Cotton*), are well-known cultivated plants, and require no notice here. *Thespesia Lampas*, Benth. and Hook. f.—Syn. *Hibiscus Lampas*, Cav., a small soft-wooded tree, with large yellow and crimson flowers, is found in Kamaon (Madden).

1. KYDIA, Roxb.

Flowers unisexual, numerous, in long panicles. Calyx campanulate, 5-lobed, persistent, surrounded by and united at the base with a 4-6-leaved involucel. Petals 5, longer than calyx, attached by their claws to the base of the staminal column. Stamens monadelphous, the tube divided down to the middle into 5 segments, each bearing from 3-8 sessile anthers closely placed together at the apex. Style one, 3-cleft; stigma large, fleshy. Capsule globose, 3-celled, opening loculicidally, 3-seeded.

1. **K. calycina**, Roxb.; Cor. Pl. t. 215; Fl. Ind. iii. 188; W. & A. Prodr. 70; Wight Ic. t. 879, 880.—Syn. *K. fraterna*, Roxb.; Cor. Pl. t. 216. *K. Roxburghiana*, Wight Ic. t. 881. Vern. *Pūli*, *pūlau*, *paulon*, *patha*, *pattāh*, *pattia*, *potari*. Local n. *Barranga*, *bhoti*, C.P.

Young leaves, branches, inflorescence, involucel, and calyx covered with a grey tomentum of stellate hairs. Leaves on petioles about half the length of blade, from 4-6 in. long, and about equally broad, with 5 or 7 palmate nerves, lobed, angled or round, margin more or less dentate, dark-coloured above, and pale beneath. Flowers polygamous, in axillary or terminal panicles; petals white or pale yellow, longer than calyx; involucel 4-6-leaved, in the male flowers at the time of flowering as long as the calyx, in the fertile flowers longer than calyx, enlarged afterwards, and when the seed ripens about three or four times longer than calyx. Capsule covered with fuscous tomentum.

Common in the dry forests of most parts of India, not in the arid region. Sub-Himalayan tract from the Indus to Assam. Oudh, Bengal, Central Provinces, the Peninsula, and Burma.

In North India generally a large shrub, in favourable localities a small tree to 40 ft. high, with a short erect trunk to 3 ft. in girth. The old leaves are shed in Feb., the new foliage appears in April and May. Flowers generally from July to Oct.; the fruit ripens in the cold season, and hangs on the tree for months, conspicuous by the brown shining calyx and involucel. Bark of trunk and large branches about 1 inch thick, inside viscid, mucilaginous, outside greyish brown, or almost black, dotted with white specks, and undulated with longitudinal wrinkles.

Sap and heartwood conform, close and straight-grained, when seasoned, weight from 40 to 45 lb. per cub. ft. Used occasionally for building, ploughs and oars, and for carving. In Garhwal a strong coarse cordage is made of the inner fibrous part of the bark. In North India the mucilaginous bark (*chūkla patha*) is employed for the clarification of sugar.

2. ADANSONIA, Linn.

Trees with digitate leaves. Flowers large, solitary. Calyx ovoid or oblong, deeply splitting into 3 to 5 lobes. Staminal column divided at the top into numerous filaments, each bearing a terminal anther. Ovary 5- to 10-celled, with many ovules in each cell; style divided at the summit into as many radiating stigmas as there are cells. Fruit oblong, woody, indehiscent, filled with pulp, mealy when dry; cotyledons very much folded, enclosing the radicle; albumen thin.

1. **A. digitata**, Linn.; Roxb. Fl. Ind. iii. 164; W. & A. Prodr. 60; Bot. Mag. t. 2791/2—*Baobab* or *Monkey-bread* tree.—Vern. *Gorak-imli.* (*Kalp*, *braksh*, near Ajmere.)

Leaves on petioles as long as leaflets; leaflets generally 5 or 7, lanceolate or obovate, acuminate, long-attenuate at base, smooth above and downy beneath. Peduncle axillary, tomentose, often very long, more than 12 in. The structure of the fruit-bearing peduncle is curious, it has 5 distinct masses of ligneous tissue, each enclosing pith. Flowers pendulous. Calyx thick coriaceous, outside tomentose, inside thickly covered with long silky hairs. Petals white, obovate, broadly unguiculate. Staminal tube thick, longer than the free portion of filaments; anthers long, linear, contorted. Ovary ovoid, silky-tomentose, tapering into a long filiform style, which is bent downwards after flowering. Fruit pendulous, a large downy oblong-obovoid capsule 8-12 in. long, when dry filled with tough stringy fibres and a mealy, slightly acid substance, in which the kidney-shaped, brown hard shining seeds are immersed.

Indigenous in tropical Africa (the village-tree, or place of assembly in the highlands of Eastern Africa). Originally introduced into India by Arab traders and cultivated in many places in the Peninsula, Bengal, and Central India. It grows near Ajmere and in the North-West, not in the Panjab. Leafless during the dry season. Fl. in May and June; the new leaves appear with or soon after the flowers.

A large tree, attaining 60 or 70 ft., remarkable for its disproportionately thick trunk, which is often irregularly shaped, rapidly tapering upward, soon dividing into large limbs, the lower frequently spreading horizontally with drooping extremities. At Deogarh in the Central Provinces are three trees, measuring respectively 16, 22, and 40 ft. in girth, and trees of much larger girth exist elsewhere. Bark of boughs and trunk thick, hard, grey or reddish brown, partially cut into irregular plates; inner bark fibrous. The Baobab was formerly supposed to attain a greater age than any other known tree. Adanson estimated the age of trees 30 ft. diameter in Senegambia at 5150 years, and Humboldt called the Baobab the oldest organic monument of our planet. This, however, seems to be erroneous. In India, certainly, it is a fast-growing tree. Roxburgh states that the largest of the trees in the Calcutta Botanic Garden was then (early this century) about 25 years old, with an irregular, short, subconical trunk, 18 ft. in circumference, from 4 to 5 ft. above ground. And recent information from Dr Kirk, H.M.'s Consul at Zanzibar, seems to show that the huge Baobabs of Africa are not of the vast age usually attributed to them.

The wood is light, soft and porous, made into rafts to support fishermen in tanks. On the western coast the dry fruit is used as floats for fishing-nets. Cordage and paper are made of the bark, and in Africa the pulp of the fruit is used for preparing an acid beverage, and the leaves, dried and powdered, are mixed with food as a condiment. It is a useful tree, which thrives well in most parts of India, and its cultivation should be encouraged.

3. BOMBAX, Linn.

Trees with digitate leaves. Calyx cup-shaped, truncate, or splitting into 3 to 5 lobes. Staminal tube short, split into 5 or more bundles, divided at the top into numerous filaments, each bearing a terminal anther. Ovary 5-celled, ovules numerous. Capsule ligneous or coriaceous, opening loculicidally in 5 valves; the seeds embedded in a woolly substance. Seeds obovoid or subglobose, cotyledons very much folded, enclosing the radicle; albumen thin.

1. **B. malabaricum**, DC.; Wight Ill. t. 29; Bedd. Fl. Sylv. t. 82; W. & A. Prodr. 61.—Syn. *Bombax heptaphyllum*, Cav.; Roxb. Cor. Pl. t. 247; Roxb. Fl. Ind. 167. *Salmalia Malabarica*, Schott. *The Cotton Tree.* Sans. *Salmali.* Vern. *Simal, semul, shembal, semur, sam, samul, simmal.* Local: *Wallaiki*, Gonds, C.P.; *Letpan*, Burm.

Glabrous, young stem and branches covered with conical prickles, ½ in. long, with a black point, surrounded at the base by concentric scaly layers of cork. Common petiole as long as, or longer than leaflets; leaflets 5 or 7, petiolulate, lanceolate, acuminate, generally from 4-8 in. long. Flowers large, scarlet, occasionally white, appearing before the leaves, on short thick pedicels, clustered towards the ends of branches. Calyx cup-shaped, coriaceous, irregularly cleft into short obtuse lobes, outside smooth, inside white-silky. Petals oblong, obtuse, 3-6 in. long, stellate, tomentose outside, pubescent or nearly glabrous inside. Staminal column short, filaments much longer, but shorter than petals, 5 innermost forked at the top, each branch bearing an anther, about 10 intermediate ones simple, and the numerous outer ones shortly united in 5 clusters; anthers long, reniform, afterwards contorted. Style longer than stamens, 5-lobed at the top. Fruit on short peduncle, a hard, oblong, obtuse, ligneous capsule, 4-5 in. long. Seeds numerous, smooth, enveloped in much fine silky fibre.

Indigenous throughout India and Burma, and often cultivated. In the sub-Himalayan tract extends to the Indus, ascending to 3500 ft. in the N.W. Himalaya, and cultivated as high as 6000 ft. Leafless from Nov. Dec. until April. Covered with the large scarlet flowers in Feb. March; the fruit ripens in April, May. A very large tree, of rapid growth, attaining a height of 150 ft. and a girth of 40 ft. in Burma and Southern India, and nearly the same dimensions in the moist and hot valleys of the outer Himalaya. The trunk is straight, the upper part cylindrical, at the base generally with large buttresses, running up the trunk to some distance, and often 5 to 6 ft. deep near the ground. Similar buttresses are formed by many trees in India (Vitex, Antiaris, Lagerstrœmia, Hymenodictyon, Nauclea, and others) and in other tropical countries. The branches are in whorls of 5 to 7, spreading nearly horizontally, and forming a broad conical symmetrical head. The branches and stem of young trees are covered with sharp thick-set prickles. Bark of trunk and older branches grey, ash-coloured, corky, even between deep longitudinal and cross-cracks.

Wood greyish white, with darker streaks, light, coarse-grained and porous. No distinct heartwood. Weight 23-34 lb. per cub. ft. (seasoned), and 58½ lb. (green). Value of P. between 642 and 697 (Cunningham). Not durable, except under water. Used for planking, packing-cases, toys, scabbards, fishing-floats, and for the lining of wells. Often rafted with heavier timber to make it float. In Burma canoes are made of it, said to last 3-4 years. A light-brown transparent gum exudes from wounds in the bark, which is employed in native medicine. The calyx of the flower-bud is eaten as a vegetable. The fruit is collected before it opens, and the cotton with which it is filled is used to stuff quilts and pillows.

ORDER XIII. STERCULIACEÆ.[1]

Trees, shrubs, or herbs, with soft wood, frequently tomentose with stellate hairs. Leaves alternate, mostly stipulate. Flowers commonly regular, bisexual or unisexual. Calyx more or less deeply divided into 5, rarely 4 or 3, valvate lobes or segments. Petals 5 or none. Stamens commonly monadelphous, with 5, 10, or 15 2-celled anthers. Fruit-carpels either distinct or united into a loculicidally dehiscent capsule. Seeds with or without albumen.—Gen. Pl. i. 214; Royle Ill. 102; Wight Ill. i. 72 (Büttneriaceæ).

Flowers unisexual or polygamous; petals none; fruit of 5 distinct or nearly distinct carpels	1. STERCULIA.
Flowers bisexual; petals 5; anther-cells divaricate; fruit-carpels distinct, or spirally-twisted	2. HELICTERES.
Flowers bisexual, with an involucel of 3-5 caducous bracts; petals 5; anther-cells parallel; fruit a capsule dehiscing loculicidally.	
Staminal column divided into 20 filaments, 5 without anthers; capsule 5-valved	3. PTEROSPERMUM.
Staminal column composed of numerous multiseriate filaments, all bearing anthers; capsule 5-10-valved .	5. ERIOLÆNA.

1. STERCULIA, Linn.

Trees, with entire, lobed, or digitate leaves. Flowers unisexual or polygamous. Calyx more or less deeply 5-cleft, rarely 4-cleft, usually coloured. Petals none. Carpels 5, distinct or nearly so, with two or more ovules in each, stalked on a long gynophore, adnate to which is th staminal column, bearing at the top 10 or 15 anthers. Fruit-carpels distinct, spreading, coriaceous or woody, dehiscent along the inner edge, or thin, foliaceous, opening long before maturity. Seeds one or more in each carpel; albumen adhering to the cotyledons, often splitting in two; cotyledons flat and thin.

Fruit-carpels coriaceous, opening at maturity.	
Leaves deeply 5-7-lobed, lobes toothed or cleft; flower panicles drooping; carpels villose, with rust-coloured tomentum .	1. *S. villosa.*
Leaves shallowly 5-lobed, lobes entire; flower panicles pyramidal, erect; carpels covered with sharp bristles . .	2. *S. urens.*
Fruit-carpels membranous, opening long before maturity . .	3. *S. colorata.*

1. **S. villosa,** Roxb. Fl. Ind. iii. 153.—**Tab. X.**—W. & A. Prodr. 63. —Vern. *Gūlkandar*, *massu*, *osha*, *gūdgudāla*, Pb.; *Udial*, Kamaon; *Udār*, *udalla*, Oudh.

A tree, with grey or brown bark; leaves on long petioles, crowded at the end of branches, tomentose beneath, nearly glabrous above, deeply 5-7-lobed; lobes oblong or ovate-oblong, toothed or cleft. Stipules broad-lanceolate, deciduous. Flowers yellow, on slender pedicels, as long or nearly as long as the calyx, loosely arranged in long drooping panicles, 5-8 panicles at the end of the leafless branch; bracts linear, caducous; male and bisexual flowers mixed, the former by far the most numerous. Calyx campanulate, membranous, border yellow, bottom of the calyx pink, outside with scattered stellate hairs. Flowers bisexual: ovary globose, on a gynophore as long as the calyx, surrounded at its base by 10 anthers inserted on a membranous ring, which is adnate to the gynophore. Fruit consisting of 2 to 7 sessile, oblong or obovoid, coriaceous carpels, 1½-3 in. long, clothed inside and outside with thick brown tomentum of stellate hairs; seeds several in each carpel.

Outer Himalaya to the Indus, ascending to 3500 feet. Panjab Salt range. Oudh forests, not common. Western coast from Guzerat southwards. South India. The old foliage is shed Dec., Jan.; new leaves issue May, June, after the flowers, which appear in March, April; the fruit ripens June, July.

Near its north-western limit this species is often only a shrub 8-10 ft. high, with a straight, somewhat irregular trunk, and a few large spreading branches. Further east and south it is a moderate-sized tree, 40-50 ft. high, with a short trunk to 5 ft. in girth, and a broad head. Bark grey or brown, smooth or somewhat rough with exfoliating scales. Wood soft and light, no distinct heartwood. The inner bark yields a coarse, very strong fibre, which is made into ropes and coarse canvas for bags. The ropes for dragging timber by elephants and buffaloes in South India are made of the bark of this species. A pellucid gum (*katīla*) exudes from the trunk.

2. **S. urens**, Roxb. Pl. Corom. t. 24; Fl. Ind. iii. 145; W. & A. Prodr. 63.—Vern. *Gūlu, kūlu, kūlru, gular, gulli*, C.P.; *Kalauri*, Panch Mehals.

A tree, with white bark. Leaves on long petioles crowded at the ends of branches, tomentose beneath, nearly glabrous above, sinuately 5-lobed; lobes entire, acuminate, sinuses shallow. Stipules caducous. Flowers small, numerous, greenish yellow, on short pedicels, supported by linear bracts longer than the bud, and deciduous after flowering. Panicles crowded, generally pyramidal, erect, every part covered with a glutinous yellow tomentum; a few bisexual mixed with a large number of male flowers. Gynophore shorter than calyx; filaments 10, alternately longer, united below into a thin sheath, which girds the gynophore. Fruit of 5 sessile radiating, ovate-lanceolate, hard, coriaceous carpels, 3 in. long, red when ripe, covered outside with many stiff bristles, which sting like those of the Cow-itch (*Mucuna*). Seeds oblong, dark chestnut-brown, from 3 to 6 in each carpel.

Terai forests and Siwalik tract, extending west to the Ganges. Behar, Central Provinces, especially the Satpura range, Bandelkhand, Gwalior, Western India from the Mhye river southwards. Common throughout the Peninsula and Ceylon, mostly on dry, rocky hills, often associated with *Boswellia thurifera*. Leafless during winter, fl. Jan.-March, the fruit ripening in April and May, and the young leaves appearing about the same time. The flowers, when touched, have an unpleasant smell, and so have the young parts of this and other species of *Sterculia*, hence the name.

A moderate-sized tree, from 30 to 50 ft. high; trunk short, often crooked and irregular, rarely exceeding 6 ft. in girth, with large spreading branches. Bark thick, cream-coloured, pink and white, smooth, shining, with a thin, white, transparent outer coat, peeling off like that of the birch. The wood is white, except the reddish part near the centre of large old trees, soft, light, used as fuel; Sitārs (native guitars) and toys are made of it on the western coast. From cracks and incisions made in the bark exudes a white gum, which is collected and sold under the name of *katila*, *katira*, with the gum of *S. villosa*, *Cochlospermum*, and other trees. The seeds are roasted and eaten by Gonds and Kurkus in the Central Provinces.

3. **S. colorata**, Roxb. Pl. Corom. t. 25; Fl. Ind. iii. 146; W. & A. 63. —Syn. *S. Wallichii*, Falc.; *Firmiana colorata*, R. Br. Vern. *Bodula*, *walena*, Pb., N.W.P.; *Samarri*, Oudh; *Khowsey*, *bhāikoi*, Bomb.

A tree. Leaves on long petioles crowded at the ends of branches, glabrous, 5-lobed, lobes acuminate. Panicles lateral or terminal, numerous, erect, bright orange-red; peduncles and calyx clothed with dense stellate pubescence. Flowers numerous, showy, about an inch long, on short pedicels. Calyx cylindrical-clavate, leathery, mouth 5-toothed. Anthers about 30, sessile on the gynophore below the ovaries. Carpels 5, oval; styles 5, short, recurved. Fruit of 1-5, stalked, oblong-lanceolate obtuse membranous carpels, opening out flat long before the seed ripens, pink outside, yellowish inside. Seeds generally 2, adhering one to each margin of the carpel near its base, size and shape of a small bean.

Forests along the foot and in the outer valleys of the Himalaya, from the Jumna south-eastward, ascending occasionally to 4000 ft. Oudh forests (rare), Central Provinces, the Peninsula, and Burma. In the dry deciduous forest. Leafless during winter, fl. March-April; the young leaves appear with or soon after the flowers. The seeds ripen June, July.

A moderate-sized tree, 50 to 60 ft. high, with an erect stem, often fluted, attaining a girth of 6 ft. Bark dark grey, reddish or brownish, with short longitudinal wrinkles, a few broad fissures, with a papery epidermis exfoliating. Wood of a dirty-white colour, with bands forming concentric lines, and conspicuous medullary rays, heartwood not distinct. Employed for ordinary agricultural work. Bark made into rope, less strong than that of *S. villosa*. Twigs and leaves lopped for cattle-fodder.

2. HELICTERES, Linn.

Calyx tubular, 5-cleft at the top, often oblique. Petals 5, equal, or the 2 upper ones broader, the claws elongated. Staminal column adnate to gynophore, bearing 5 or 10 anthers; anther-cells divaricating, often confluent into one. Ovary 5-lobed, 5-celled, with several ovules in each cell; styles 5, subulate, more or less connate. Fruit-carpels distinct or separating, opening along their inner edge, straight or spirally twisted. Seeds with little albumen; cotyledons leafy, folded round the radicle.

1. **H. Isora**, Linn.; Roxb. Fl. Ind. 143; W. & A. 60; Wight Ic. t. 180. —Syn. *Isora corylifolia*, Schott et Endl. Vern. *Maror phal*, *jonka-phal*, *kapāsi*, Pb., N.W.P.; *Bhēndu*, Oudh; *Antēri*, Banswarra; *Kewan*, *maradsing*, Bomb.

Young branches and leaves covered with rough pubescence, chiefly of stellate hairs. Leaves on short petioles, broadly obovate or orbicular, shortly acuminate, base slightly cordate, often oblique, irregularly toothed, scabrous above, tomentose beneath; stipules deciduous. Peduncles short, axillary, bracteate, usually 2 or 4. Calyx about ½ in. long or longer, obliquely and unequally 5-toothed. Petals red, twice as long, reflexed. Gynophore at the time of flowering as long as petals, afterwards elongated. Anthers 10, on short filaments, alternating with the teeth of the staminal tube. Fruit 1-2 in. long, on a gynophore nearly as long, cylindrical, composed of 5 spirally twisted tomentose carpels.

Bengal, South and Central India. Banswara. Oudh forests (common). Sub-Himalayan tract as far west as the Jhelam. A shrub, or small tree; new leaves in April; fl. April, May, and throughout the rainy season; the ripe fruit on the tree in winter. The branches are used for fencing, and thatching; the bark yields a strong white fibre, made into coarse cordage and canvas for gunny-bags. Fruit and leaves used in native medicine.

3. PTEROSPERMUM, Schreb.

Trees or shrubs, pubescent with stellate hairs. Calyx 5-cleft, deciduous. Petals 5, deciduous. Staminal column adnate to the gynophore, divided at the top into 20 filaments, 5 without anthers (staminodia), 15 with linear anthers, the cells parallel, opening longitudinally. Ovary sessile on the top of the column, 5-celled, with several ovules in each cell; style undivided, club-shaped and 5-furrowed at the top. Capsule woody or coriaceous, opening loculicidally in 5 valves. Seeds produced into a wing at the top; albumen little or none; cotyledons wrinkled or folded.

Leaves peltate or obovate-oblong	1. *P. acerifolium.*
Leaves lanceolate	2. *P. lanceæfolium.*

P. semisagittatum, a large tree from Burma, Chittagong, distinguished by lanceolate, semisagittate leaves; large, broad, laciniate stipules, which fall after the leaves are fully developed; broad laciniate bracts, large obovate petals, and an oblong fruit 3 in. long; is cultivated at Saharunpore and elsewhere in North-West India, but is not indigenous.

1. **P. acerifolium**, Willd.—**Tab. XI.**—Roxb. Fl. Ind. iii. 158; W. & A. Prodr. 69; Wight Ic. t. 631; Bot. Mag. 620.—Sans. *Karnikāra.* Vern. *Kanak-champa*, Beng.; *Taun-pœwūn*, Burm.

A large tree. Young branches and calyx covered with thick ferruginous tomentum. Stipules many-cleft, caducous. Leaves large, peltate or obovate-oblong, sinuately lobed, glabrous above, and grey tomentose beneath. Flowers fragrant, axillary, on short pedicels, with many-cleft bracts. Calyx deeply 5-cleft; segments linear, up to 5 in. long. Petals linear or obliquely wedge-shaped, pure white. Capsule ligneous, brown-tomentose, pentagonal, 2-6 in. long. Seeds numerous, obliquely oval, compressed, with large, brown, thin membranous wings.

Burma and hills of Eastern Bengal. Doons between Jumna and Sarda. Banks of the Jumna below Mussoorie (wild ?). Cultivated throughout India. Fl. from March to June, fruit ripens in the cold season. Wood of a light-red colour, firm. In the N.W. a moderate-sized tree, attains a large size in Burma.

2. **P. lanceæfolium**, Roxb. Fl. Ind. 163.—Vern. *Ban kalla*, Beng.

A large tree. Young shoots and underside of leaves with short white or tawny tomentum. Stipules subulate. Leaves alternate, bifarious, lanceolate, acuminate, entire. Flowers fragrant, axillary, on peduncles longer than calyx, with 2 or 3 linear, laciniate bracts. Sepals linear, revolute, 1 in. long. Petals obliquely cuneiform, white. Capsules lanceolate, hoary, 5-celled. Seeds 2-4 in each cell, winged.

Burma, hills of Eastern Bengal. Sub-Himalayan tract as far west as the Jumna (wild ?). A tree of considerable size. Fl. May-June.

4. **ERIOLÆNA,** DC.

Shrubs or trees, with cordate leaves and deciduous stipules. Flowers on axillary few-flowered peduncles. Calyx deeply 5-cleft, with an involucel (epicalyx) of 3-5, often laciniate bracts. Petals 5, with a broad, coriaceous, hairy claw. Stamens numerous, all fertile, monadelphous, in many rows, the outer ones gradually shorter; anthers linear-oblong, with parallel cells. Style one; stigma 10-lobed. Capsule woody, 5-10-celled, dehiscing loculicidally, the dissepiments attached to the valves. Seeds numerous in each cell, terminated by a broad, oblong, or tapering wing.

1. **E. Hookeriana,** W. & A. Prodr. 70; Bedd. Fl. Sylv. anal. gen. t. v.

A shrub or small tree. Leaves cordate, shortly acuminate, toothed, 3 in. broad, and about as long, petioles half the length of leaf; stipules linear, caducous. Young shoots, petioles, under side of leaves, inflorescence, bracts and outside of calyx clothed with dense light-grey stellate tomentum; upper side of leaves with scattered tufts of stellate hairs, or glabrate. Flowers 3-5, peduncles as long as or longer than leaf. Calyx-segments lanceolate, ¾-1 in. long. Bracts deeply cut into numerous linear segments. Style hairy. Capsule 7-9-celled, ovoid, 1 in. long or nearly so, valves not keeled, tubercled outside.

South India. Behar. Common Satpura range. Guna (Gwalior). Fl. March, April. Fruit autumn and cold season.

A sp. of *Eriolæna,* with leaves 5-6 in. across; petioles nearly as long as leaf, I found (in leaf only) in the Panch Mehals in Jan. 1870. (Vern. *Jehāli, budjāri-dhamin.*) It resembles *E. Stocksii,* Hf. & Th. (from the Concan); but I am inclined to think that the differences between *E. Hookeriana, E. flavescens,* Garcke, and *E. Stocksii,* are not very great.

In Nov. 1863 I found a tree on the Choti Gandak in Gorakhpur, vern. *Beem,* with large cordate, dentate leaves 6 in. broad, petioles 2 in., and oblong capsules, valves 8 villose, and obtusely keeled on the back, but not tubercled, which may possibly belong to *E. spectabilis,* Wall., a tree in Nepal with fine, close-grained wood; and among the plants collected by R. Thompson in Oudh, are young shoots of an *Eriolæna,* buds clothed with stellate tomentum of long soft white hairs, stipules lanceolate, laciniate, bracts ovate, laciniate to about the middle, which may be referred to the same species. A tree of this genus from Burma (*Doani*) has beautiful red wood, which polishes well, and is not heavy, the cub. ft. weighing 47 lb.

ORDER XIV. TILIACEÆ.

Mostly trees or shrubs, with alternate simple leaves, and deciduous stipules. Flowers regular, generally bisexual and pentamerous. Sepals free or connate, valvate. Petals free. Stamens numerous, free or connate; anthers 2-celled. Ovary free, 2-10-celled; ovules definite or indefinite; placentation axile. Fruit generally 2-10-celled. Seeds with or without albumen.—Gen. Pl. i. 228; Royle Ill. 103, 104; Wight Ill. i. 79, 82.

Leaves 3-7-nerved at base; anthers bursting longitudinally . . 1. GREWIA.
Leaves penniveined; anthers opening by slits at the top . . 2. ELÆOCARPUS.

To this family belong *Berrya Ammonilla* of Ceylon, distinguished by a 6-winged capsule, which yields the *Trincomalee* wood; the *Lime*-tree of Europe, *Tilia europæa,* with wing-like bracts, and globose indehiscent 1-2-seeded fruit, and *Corchorus capsularis*, extensively cultivated in Bengal, and now one of the principal articles of export from Calcutta, yielding the Jute of commerce, with a round, 5-celled, many-seeded capsule.

1. GREWIA, Linn.

Trees or shrubs; extremities and leaves pubescent or tomentose with stellate hairs. Leaves with 3-7 basal nerves, generally with lateral nerves from midrib, and more or less distinct transverse veins at right angles. Flowers regular, bisexual, pentamerous; inflorescence cymose. Sepals distinct, deciduous, coriaceous, coloured on the inner side. Petals clawed, with a gland or hollow on the inside of the thickened base, sometimes wanting. Stamens indefinite, all fertile, free, inserted on a raised, often glandular torus. Ovary 2-4-celled; style subulate, stigma shortly 2-4-lobed. Fruit a drupe, 1-4-stoned, entire or lobed, stones 1- or more-seeded, and divided by spurious dissepiments between the seeds. Embryo with flat leafy cotyledons in a fleshy or horny albumen.

Peduncle generally one, opposite to leaf.
  A tree; flowers yellow, in umbellate cymes . . . . 1. *G. oppositifolia.*
  A small shrub; flowers white, 2-3, or solitary . . . 2. *G. populifolia.*
Peduncles axillary, generally more than one.
  Leaves oblong, ovate, or cordate.
    Drupe, when dry, with a distinct crustaceous or coriaceous rind.
      Leaves oblong; drupes small, on long pedicels . . 3. *G. pilosa.*
      Leaves orbicular, deeply cordate; drupes glomerate, nearly sessile, ¾ in. across . . . . 4. *G. villosa.*
      Leaves ovate or obovate; drupes pedunculate, nearly 1 in. across . . . . 5. *G. sclerophylla.*
    Drupe fleshy, wrinkled when dry, no distinct coriaceous rind.
      Trees; peduncles varying in length, never as long as leaves.
        Tomentose; leaves obliquely ovate, stipules linear; buds not ribbed, ovoid, petals yellow . . . . 6. *G. vestita.*
        Tomentose; leaves obliquely cordate, stipules lanceolate, with broad, oblique base; buds ribbed, cylindrical or clavate, petals red and yellow . . . 7. *G. asiatica.*
        Pubescent or hoary; leaves obliquely ovate-rhomboid, often with cordate base; stipules falcate, auriculate; buds cylindrical or obovoid . . . . 8. *G. tiliæfolia.*
      Herbaceous undershrubs; pedicels long slender . . 9. *G. sapida.*
  Leaves lanceolate or ovate-lanceolate.
    Leaves nearly glabrous, ovate-lanceolate . . . . 10. *G. lævigata.*
    Leaves grey-tomentose or hoary beneath, lanceolate.
      Flowers mostly unisexual; leaves sharp-serrate . 11. *G. polygama.*
      Flowers bisexual; leaves entire or serrulate, margin often undulate . . . . 12. *G. salvifolia.*

1. **G. oppositifolia**, Roxb. Fl. Ind. ii. 583.—**Tab. XII.**—Wight Ic. t. 82.—Vern. *Pastūwanne*, Afg.; *Dhamman, bhamman, pharwa*, Pb.; *Bīūl, bīūng, bewal, bāhūl, bemal, bhīmal, bhengūl*, N.W.P.

Branches, leaves, and inflorescence rough with stellate hairs. Leaves 2-4 in. long, on short petioles, ovate, acuminate, often unequal at base, obtusely serrate, 3 or 5 nerves proceeding from the base, scabrous-tomentose on both sides, the stellate hairs closer together beneath; stipules subulate, early deciduous. Inflorescence umbellate. Peduncle generally one, inserted more or less opposite the petiole; pedicels 3 to 7 or more, with linear bracts at their base, about ¾ in. long when in flower; peduncles ½-1 in. long. Flowers large, yellowish. Sepals linear, about ¾ in. long or longer, outside densely tomentose, with a prominent midrib between 2 deep furrows, giving the appearance of 3 nerves, inside reddish, smooth, with 3 to 7 parallel nerves. Petals linear, shorter than sepals, yellowish red. Drupe consisting of from 1 to 4 more or less distinct lobes, each the size of a small pea, fleshy, first olive-green, then wrinkled black, with scattered stellate hairs, glabrous when ripe.

Common; wild in the North-West Himalaya, from the Indus to Nepal, ascending to 6000 feet. Occasionally in the Salt range and other hills in the Panjab; also in the Suliman range, trans-Indus. Frequently planted near villages and houses in the hills. Leaves shed in March; the new foliage issues in April or early in May; fl. March-June, chiefly in May; fruit ripens Oct.-Dec.

A moderate-sized tree, 40 ft. high, with a straight short trunk, attaining 3 to 4 ft. in girth. Branches spreading, branchlets somewhat bifarious. Bark of trunk and larger branches ½ inch thick, ash-coloured, smooth, longitudinally rugose. Wood white, light, very tough, used where strength and elasticity are required, for oar-shafts, handles, shoulder-sticks for loads, bows (*goleil*) used to propel a ball as missile. The chief use of the tree is to furnish fodder for goats and sheep during winter; for this purpose the tree is lopped annually, the twigs and leaves are dried and stored between its branches. The inner bark is steeped in water 10 to 15 days, then beaten and made into cordage, used for sandals, boat and cattle ropes; but is not durable. Paper has also been made of it. The fruit is eaten.

2. **G. populifolia**, Vahl; W. & A. Prodr. 80; Boissier Fl. Orient. i. 843; Oliver Fl. Trop. Afr. i. 246.—Syn. *G. betulæfolia*, Roth. Vern. *Ganger*, Pb.; *Gungo*, Sindh; *Gangerun*, Rajputana.

Branchlets rough with short stellate hairs. Leaves variable in form, generally broad-ovate, short-acuminate, more rarely obovate and obtuse or cuneate, sharp-dentate or irregularly serrate, and frequently thickened at the edges, greyish green on both sides, rough with short stellate hairs, with 3, rarely 5, nerves from base; petioles ¼-⅓ in. long. Stipules subulate, early deciduous. Peduncles generally solitary, opposite to the leaves, 1-flowered or 2-3-flowered. Flowers large, white; sepals ½-¾ in. long; petals shorter, the linear blade attached to the back of a ciliated scale (the claw), which fits round the angular torus. Drupe 2-lobed, shining, smooth, orange red when ripe; the lobes distinct, the size of small peas, each with a 2-celled stone.

Common on low hills trans-Indus, in the Salt range to 3000 ft., and in the more arid tracts of the Panjab as far as Delhi. Sindh, Afghanistan, Aden, N.W. Himalaya, ascending to 2000 ft. Dry hills of Rajputana. Peninsula. Tropical Africa, Egypt, Persia. A small shrub, with slender branches; the fruit, with a scanty but pleasant pulp, is eaten in Sindh. Fl. in the cold season. The wood makes good walking-sticks.

3. **G. pilosa**, Lam. ; W. & A. Prodr. 78.—Syn. *G. carpinifolia*, Roxb. Fl. Ind. ii. 587.

Branchlets, leaves, and inflorescence rough with short light-brown stellate tomentum. Leaves subcoriaceous, 2-4 in. long, on short petioles, oblong, shortly acuminate, serrate, base obtuse or cordate, the middle nerve with 4-5 main lateral nerves on either side, the lowest pair proceeding from near the base; transverse veins prominent. Peduncles axillary, 1-3, short, ¼ in. long; pedicels 1-3, same length. Flower-buds oblong, dilated at the base, constricted in the middle. Sepals linear, ½ in. long. Petals one-third shorter than sepals, linear, emarginate. Drupe 1-4-lobed, ⅓ in. across, on pedicels ½ in. long, with a crustaceous rind, covered with stellate pubescence. Specimens in leaf only may be distinguished by the cordate or rounded base of the oblong, short-acuminate leaves, with prominent transverse veins.

North-West India, Behar, Bandelkhand, Central Provinces, Rajputana, Guzerat, and South India. A shrub; fl. July-Sept; the fruit ripens in the cold season. The fruit of a shrub near this, and probably the same, called *Karanto*, on the Bassi hills, east of the Bunass river in Meywar, is eaten.

G. hirsuta, Vahl. ; W. & A. Prodr. 78—syn. *G. pilosa*, Roxb. Fl. Ind. ii. 588—is a shrub in South India with some resemblance to *G. pilosa*, Lam., with lanceolate, thick and soft-tomentose, penninerved and wrinkled leaves; buds ovoid; sepals ¼ in. long, or less. Drupes slightly lobed, with long stiff hairs.

4. **G. villosa**, Willd. ; W. & A. Prodr. 79; Dalzell & Gibson, Bombay Flora, 25.—Vern. *Inzarra, pastuwanne*, T.I. ; *Jalidar, kaskūsri, thamther*. Salt Range; *Gawāl kopra*, Kishengurh.

Young parts and leaves clothed with long soft hairs. Leaves 1-3 in. long, rugose above, villous beneath, nearly orbicular, deeply cordate, sharp-serrate, serratures bearded with tufts of long soft hairs. Petioles ½-1 in. long. Basal nerves 3-6; lateral nerves 3-4 on either side of midrib, and on the outer side of the basal nerves; transverse veins prominent. Stipules ovate-lanceolate, deciduous. Flowers dull yellow, in short compact axillary cymes. Sepals linear, clothed with long soft hairs; petals much shorter than sepals. Fruit globose, the size of a cherry when dry, with a crustaceous, brown or reddish rind, covered with tufts of long stellate hairs. Stones 4, 1-2-seeded, in a sweet edible pulp.

Sindh, Panjab, trans-Indus, Salt range, Rajputana, the Konkan. South India, tropical Africa and Cape de Verde Islands. Fl. June-Sept. A small shrub. The fruit is eaten.

5. **G. sclerophylla**, Roxb. Hort. Beng. 42.—Syn. *G. scabrophylla*, Roxb. Fl. Ind. ii. 584; Wight Ic. t. 89. Vern. *Pharsia*, Kamaon.

Branchlets, inflorescence, and under side of leaves clothed with soft tomentum. Leaves scabrous above, ovate or obovate, obtuse or shortly acuminate, unequally serrate, 3-9 in. long; petioles ¼-½ in. long; transverse nerves distinct; stipules linear, deciduous. Peduncles axillary, generally 1-4 together, of various length, 2-3-flowered; bracts small subulate, caducous. Flowers white. Sepals linear-lanceolate, nearly 3 times the length of the petals. Drupe the size of a large gooseberry, nearly round, when ripe brownish grey and a little hairy, with a coriaceous rind when dry, pulp sweet, glutinous, pale yellow. Nuts 4, obovoid, rugose, thick and hard, 1-2-seeded.

A small shrub or undershrub, 3-4 ft. high, common in the Doons and Siwaliks from the Jumna eastward. Oudh forests. Sikkim. Fruit eatable (*Gūrbheli*). Fl. April-Sept.

G. abutilifolia—Juss. *G. aspera*, Roxb. Fl. Ind. ii. 591—arborescent, from South India, resembles this sp. in leaves and inflorescence.

6. **G. vestita**, Wall.—Syn. *G. elastica*, Royle Ill. t. 22. Vern. *Farri*, *phalwa*, *dhamman*, Pb.; *Pharsia*, *pharsāi*, *pharsūla*, *dhamūn*, *dhamman*, N.W.P.; *Phalsa*, *dhamin*, *damon*, C.P.

Young branches, under side of leaves, and inflorescence with soft grey tomentum. Leaves 2-4 in. long, on short petioles, obliquely ovate, acuminate, serrate, sometimes indistinctly 3-lobed, with 5 or 6 basal nerves, pale beneath; stipules linear, nearly as long as petiole. Cymes compact, axillary. Peduncles short, 3 to 5 or more, generally not longer than ½ in., each bearing 2 or 3 pedicels of about the same length, supported by linear bracts. Flower-buds ovoid. Sepals linear-lanceolate, about ½ in. long; nerves indistinct, outside softly tomentose with long fine hairs, inside glabrous, yellow. Petals much shorter than sepals. Drupe pear-shaped or globose, of the size of a pea, fleshy, 2-4-lobed, black when ripe.

Outer Himalaya, as far west as the Indus. Salt range. Eastern Bengal. Behar and Central Provinces. New leaves appear in May; the flowers, which are orange-yellow, not very conspicuous, from Jan. to May; the fruit ripens Aug. to Nov.

A small tree, 25 ft. high, with a trunk rarely exceeding 2 ft. girth. Bark of stem cinereous or dark brown, smooth, longitudinally rugose. Sapwood white or light brown; heartwood pale yellow, reddish brown, or grey brown, fairly close, fine and even-grained, when seasoned weighing about 50 lb. per cub. ft., strong, tough, and elastic. Used for shoulder-poles for loads, bows, spear-handles. Fruit eaten.

7. **G. asiatica**, Linn.; W. & A. Prodr. 79; Roxb. Fl. Ind. ii. 586.—Vern. *Phalsa*, *phalsi*, *dhāmin*.

Young branches, under side of leaves, and inflorescence with soft grey or yellowish tomentum. Leaves 2 to 7 in. long, obliquely cordate or broad-ovate, acuminate, irregularly toothed, with 5, 6, or 7 arching nerves proceeding from the base; stipules linear-lanceolate, often with a broad oblique base; petioles ½ in. long. Peduncles axillary, 2 to 7, varying in length from ½-2 inches, but mostly 1-2 in. long, bearing from 3 to 5 flowers on bracteate divaricating pedicels, shorter than peduncle. Flower-buds ribbed, cylindrical or clavate. Sepals varying in length, generally ¾ in. long, whitish-tomentose outside, reddish brown or yellow inside. Petals red and yellow, emarginate, half as long as sepals. Drupe globose, dark brown when ripe, indistinctly lobed, with 1 or 2 nuts.

Cultivated throughout India, in Burma, and the Mauritius. Said to be wild in the Poona district (Dalz. & Gibson, Bombay Fl. 26), the Salt range, Garhwal, the Oudh forests (R. Thompson), and the Banda district (Edgeworth). Outside India, in Upper Guinea and South Central Africa, with obliquely cordate leaves, soft tomentose on both surfaces (Oliv. Fl. Trop. Afr. i. 249). In Dec. 1869, I found a shrub (in leaf only) wild on the dry hills of the northern Aravalli near Todgarh, called *Dhāmin,* which I refer to this species. A month later, I found what appeared to me the same plant in Banswara as a tree, called *Damanat.* Eventually it may be right to unite *G. vestita* with *G. asiatica.* I admit that the specific differences here given are slight, and further researches may possibly remove them altogether. At present, however, it seems to me more convenient to keep the two species separate.

New leaves about the end of March. Fl. Feb. March ; fruit ripens in the following months. A middle-sized tree, 25 ft. high, with short trunk 3-4 ft. in girth. Bark ⅓ in. thick, grey or dark brown, undulating, smooth with shallow longitudinal cracks. Sapwood whitish ; heartwood reddish brown, with many minute pores, close, even-grained, strong, tough, elastic. Bark employed for making rope, mucilaginous, used for refining sugar in Saharanpur district. Cultivated for the small, not very succulent, pleasantly acid fruit.

8. **G. tiliæfolia,** Vahl. ; W. & A. Prodr. 80 ; Roxb. Fl. Ind. ii. 587 ; Bedd. Fl. Sylv. t. 108.—Vern. *Pharsa,* Oudh ; *Dhamin,* C.P.

Young branches and leaves pubescent, with scattered stellate hairs. Leaves on petioles ½-1 in. long, obliquely ovate, sometimes rhomboid, acuminate, bluntly toothed or serrate, with 5 basal nerves, 3 of which are prominent and penniveined, upper side at length glabrous, under side more or less pubescent. Stipules broad-lanceolate, often falcate and auriculate. Peduncles axillary, numerous (3-10), 3-5-flowered ; bracts deciduous. Flower-buds cylindrical or obovoid. Sepals linear, ¼-½ in. long, pubescent outside, glabrous inside. Petals oblong, half the length of sepals. Drupes globose, size of a pea, indistinctly lobed.

Hot, dry forests throughout India, Siwalik tract from the Jumna to Assam. Oudh, Behar, Bandelkhand, Central Provinces, the Konkan and the Peninsula. Frequently associated with Sāl. Leaves shed in March ; new foliage in April. Fl. in April and May ; fruit ripens from June to October.

A moderate-sized tree, 30-35 ft. high, with an erect, straight trunk, 4-5 ft. in girth. Bark ½ in. thick, cinereous, with dark blotches, rough with exfoliating scales. Sapwood whitish ; heartwood light reddish brown, compact, close-grained. Weighs 30-40 lb. per cub. ft. Easily worked, elastic, durable. Contracts and expands much with wet and dry weather, but is valuable where strength and elasticity are required. Made into shafts, shoulder-poles for loads, pellet-bows, handles, masts, oars, employed in cart and carriage building. From the inner bark cordage is made in Bombay. Twigs and leaves lopped for fodder. Fruit eaten, of an agreeable acid flavour.

9. **G. sapida,** Roxb. Fl. Ind. ii. 590.—Syn. *G. nana,* Wall.

Pubescent or tomentose. Leaves ovate or obovate, serrate, 3-5-nerved, often shallow-lobed, pale beneath ; petioles ¼ in. long. Stipules subulate. Peduncles 2-5, axillary, slender, 1 in. long, each with 2-5 flowers on short, divergent, often divaricate, pedicels. Flowers yellow ; sepals linear-oblong; petals nearly entire. Drupe the size of a pea, slightly 2-4-lobed.

A small undershrub, common in pastures in the Doons and the sub-Himalayan tract, from the Jumna to Assam, ascending to 3000 ft., with a short, thick, woody stem underground, throwing up annually a number of herbaceous shoots, seldom more than a few ft. high. These, after bearing leaves, flowers, and fruit, are generally burnt down by the jungle-fires of the hot season. The fruit is small, but palatable.

10. **G. lævigata**, Vahl; W. & A. Prodr. 77.—Syn. *G. didyma*, Roxb. Fl. Ind. ii. 591. Vern. *Kat bhewal*, *bhimūl*, N.W.P.; *Kakki*, Oudh.

Nearly glabrous, extremities and young leaves pubescent with scattered stellate hairs. Leaves bifarious, on short petioles, ovate-lanceolate, long-acuminate, serrate, base acute, 3-6 in. long, penniveined, the lowest pair of nerves from the base; transverse nerves not prominent. Stipules caducous. Peduncles axillary, 2-3 together, slender, nearly an inch long, each bearing 3 yellowish flowers on shorter bracteate pedicels. Buds oblong, ribbed. Sepals linear, ½ inch long or more, pilose. Petals oblong, entire, obtuse, less than ⅓ the length of sepals. Drupe glabrous, consisting of 2, rarely 3, distinct lobes, each lobe containing one or two 1-celled nuts. Specimens in leaf only may be distinguished by the nearly glabrous long-acuminate leaves with acute base; transverse veins not prominent.

Outer Himalaya, as far as the Jumna, ascending to 3000 ft. Plentiful in the Gonda and Baraitch divisions of the Oudh forests. Bengal, Behar, and Central Provinces. Leaves are shed and renewed in April. Fl. June-Sept. A small tree, 20 ft. high, 2 ft. girth, with a short, erect trunk, and a smooth, greenish, cinereous bark. Wood white, even-, close-grained, elastic; no distinct heartwood. Twigs and leaves lopped for cattle-fodder in the N.W. Provinces.

G. sepiaria, Roxb. l. c. 589, is nearly allied to this sp., but has solitary peduncles, employed to make hedges in Bengal.

11. **G. polygama**, Roxb. Fl. Ind. ii. 588.—Syn. *G. helicterifolia*, Wall.

Extremities grey-tomentose, branchlets pubescent. Leaves bifarious, on short petioles, lanceolate, 2-3 in. long, sharp-serrate, penniveined, the lowest pair of nerves from the base, glabrescent above, white or grey-velvety beneath. Stipules subulate, longer than petioles. Flowers polygamous, mostly unisexual. Peduncles slender, axillary, 1-5 together, much longer than petiole, ½-1 in. long, pedicels 2-4, shorter than peduncle. Petals half the length of sepals. Male flowers: stamens about 20, inserted on an elevated torus. Female flowers: anthers effete, on short filaments; stigma large, stellate. Drupe ½ in. diam., indistinctly 4-lobed, shining, with a few scattered hairs. Stones 4, 1-seeded.

Outer Himalaya, from the Chenab to Assam, ascending to 4000 ft. Salt range, Panjab. Behar, the Konkan, Burma, Ceylon. North Australia. A shrub or small tree, with a short trunk, bifarious spreading branches, and a small rounded crown. Fl. July-Aug.; fruit ripe, Nov. Dec.

12. **G. salvifolia**, Heyne; W. & A. Prodr. 77.—Syn. *G. bicolor*, Juss. Vern. *Bather*, *nikki-bekkar*, *gargas*, Pb.

Extremities and under side of leaves covered with short white or grey hoary pubescence. Leaves lanceolate, 2-3 in. long, margin entire undulate or serrulate, 3 basal nerves, and 2 or 3 lateral nerves on either side of midrib; transverse veins indistinct; petioles ¼ in. long. Stipules linear, longer than petiole, with a distinct nerve. Peduncles axillary, 1, 2, or 3, longer than petiole, 2-3-flowered; pedicels as long as, or longer than peduncles. Flowers conspicuous, of a fine yellow; petals obovate, bifid, half the length of sepals. Drupes of 1-2 more or less distinct subglobose lobes.

Panjab, cis- and trans-Indus (ascends in the Salt range to 3000 ft.), Sindh, Central Provinces, and the Peninsula. A shrub or small tree 16-20 ft. high, with a short, straight stem, attaining a girth of 18-24 in. Bark light grey to reddish brown, or blackish, longitudinally rugose. Fl. Feb., March; fruit small, not succulent, subacid, eaten.

G. Rothii, DC.; W & A. Prodr. 78—syn. *G. salvifolia*, Roxb. l. c. 587—Coromandel and Bandelkhand, with broader, finely serrate leaves, and distinct transverse veins, is nearly allied to this, and perhaps not specifically different.

2. ELÆOCARPUS, Linn.

Flowers in axillary racemes, generally bisexual. Sepals 4 or 5. Petals as many as sepals, fringed or lobed, rarely entire, inserted round the base of the thick glandular torus; induplicate-valvate in bud. Stamens numerous, inserted on the torus between the glands; anthers linear, opening at the top in 2 confluent short slits. Ovary 2-5-celled; style one, subulate. Fruit a drupe with one kernel, 1- or 2-5-celled, one seed in each cell. Albumen fleshy; cotyledons flat, broad.

1. **E. Ganitrus**, Roxb. Fl. Ind. ii. 592; Wight Ic. t. 66.—Sans. *Rudrāksha*. Vern. *Rudrak*, *rudraksh*.

Leaves alternate, approximate near ends of branches, on petioles many times shorter than the leaf, ovate-lanceolate, indistinctly serrate, slightly silky when young, afterwards glabrous on both sides, about 6 in. long. Stipules minute, caducous. Racemes below the leaves, on two-year-old branchlets, unilateral, drooping; bracts deciduous; pedicels as long as flowers. Sepals 5, lanceolate, acute, silky. Petals 5, oblong, divided into numerous subulate segments. Filaments 25-40, short, inserted on the large convex disc. Ovary ovoid, villous, 5-lobed, 5-celled; style 5-grooved. Drupe globose, size of a large cherry, purple; nut globose, thick, very hard, 5-celled, surface elegantly tubercled, marked with 5 equidistant grooves, running from the apex to the base. Seed generally one in each cell. Cotyledons oblong, thin, 3-nerved.

Nepal, Assam, Western Ghats, and probably occurs in the southern forests of the Central Provinces. A large tree, flowers in the cold season, and ripens its fruit in autumn. The hard, tubercled nuts are polished, made into rosaries and bracelets, worn by Brahmins and Fakirs, and are frequently set in gold.

Another species, *E. serratus*, Roxb. l. c. 596, with bluntly serrate, ovate leaves, petioles ½ or ⅓ length of leaf, exterior anther-valve bearded, and a 3-

celled ovary, is said to have been found in Kamaon. The fruit (*Julpai*, Beng.), size and shape of an olive, is pickled; nut oblong, smooth, not tubercled.

Numerous species of this genus are in the forests of South India and Burma.

ORDER XV. MALPIGHIACEÆ.

Usually climbing shrubs with opposite simple leaves; exstipulate, or stipules inconspicuous. Flowers regular, bisexual, pentamerous, usually yellow, white, or red. Calyx deeply divided, usually with one or more sessile glands outside (eglandular in *Aspidopterys*). Petals free, clawed or sessile, toothed or entire. Stamens hypogynous, 10. Ovary free, 3-celled and 3-lobed; placentation axile; ovules solitary. Fruit-carpels 1-3, usually winged (samaroid). Seed exalbuminous.—Gen. Pl. i. 247; Royle Ill. 133; Wight Ill. i. 136.

Petals clawed, unequal; 1 stamen longer than the rest; style one; carpels winged at the end	1. HIPTAGE.
Petals sessile; all stamens equal; styles 3; carpels winged all round	2. ASPIDOPTERYS.

1. HIPTAGE, Gærtner.

Climbing shrubs, with opposite, coriaceous, entire leaves, without stipules. Calyx 5-parted, with a large oblong gland outside, adnate to pedicel and calyx. Petals 5, unequal, unguiculate, silky. Stamens 10, declinate, all antheriferous, one much longer than the rest. Ovary 3-lobed; style 1, filiform. Fruit of 1-3 samaras, connate at the base, and terminating in long wings.

1. **H. Madablota,** Gærtn.; W. & A. Prodr. 107.—Syn. *Gærtnera racemosa*, Roxb. Cor. pl. t. 18; Fl. Ind. ii. 368. Vern. *Kampti*, C.P.; *Mad malti*, *aita lagūla*, N.W.P.; *Endra*, *chopar*, *benkar*, *khumb*, Pb. hills; *Chabuk chūri*, Pb. plains; *Halad-wail*, Mahratta.

A large climbing shrub. Leaves glabrous, elliptic or elliptic-oblong, acuminate, 4-6 in. long, on short, channelled petioles, penniveined, main lateral nerves arcuate, 4-6 on either side of midrib. Flowers showy, ¾ in. across, white and yellow, in large terminal panicles; pedicels articulate, with 2 subulate bracts in the middle. Carpels 3, wings oblanceolate, unequal, one about 2 in. long, the two others shorter.

Common in ravines and moist places in most parts of India. Often on Sāl trees. Sub-Himalayan tract to Indus, ascending to 3000 ft. Mt. Aboo, Burma. Ceylon. China. Fl. Jan.-March. Fr. May. Bark bitter.

2. ASPIDOPTERYS, A. Jussieu.

Climbing shrubs, with opposite, entire leaves, without stipules. Calyx 5-parted, without a gland. Petals 5, equal, not clawed. Stamens 10, equal, all antheriferous. Ovary 3-lobed; styles 3, short. Fruit of 3 samaras; the seed in the middle of a circular, oblong, or ovate membranous wing.

1. **A. lanuginosa,** A. Juss.—Syn. *Hiræa lanuginosa*, Wall. Pl. As. Rar. i. 13.

A large climber. Leaves cordate or ovate-cordate, long-acuminate, 4-6 in. long; petiole ¾ in. long. Under side of leaves, young shoots, and inflorescence clothed with soft, grey, silky tomentum. Flowers ¼ in. across. Ovaries tomentose, with long white hairs. Wings of fruit oval, 1½ in. long.

Nepal, Kamaon (to 4000 ft.), Dehra Doon. Fl. June.

A. nutans, A. Juss.—Syn. *Hiræa nutans*, Roxb. Fl. Ind. ii. 447; W. & A. Prodr. 108, is similar, but has glabrous leaves and longer petioles. Bengal.

A. Roxburghiana, A. Juss.—syn. *Triopteris indica*, Roxb. Cor. pl. t. 160; *Hiræa indica*, Roxb. Fl. Ind. ii. 448, W. & A. Prodr. 108—has glabrous leaves, ovary with short hairs, and oblong fruit-wings. South India, Bengal, Nepal, Burma.

ORDER XVI. GERANIACEÆ.

Herbs or shrubs, rarely trees, with opposite or alternate leaves. Flowers bisexual. Sepals 5, rarely fewer, free or more or less connate. Petals as many as sepals or wanting, hypogynous or perigynous, imbricate or contorted. Stamens generally twice the number of petals; anthers versatile, 2-celled, without connective, the cells parallel, dehiscing longitudinally. Ovary of 3-5 carpels, 3-5-celled and -lobed, the carpels adnate to the axis below; ovules 1 or 2 in each cell, rarely numerous (as in Averrhoa). Fruit various; albumen scanty or none.—Gen. Pl. i. 269; Royle Ill. 152; Wight Ill. i. 160 (*Oxalideæ*).

1. AVERRHOA, Linn.

Trees with alternate, imparipinnate leaves, without stipules. Flowers in cymose panicles, small, regular. Sepals 5, imbricate. Petals 5, hypogynous, contorted. Stamens 10, slightly connate at the base, 5 shorter, 5 longer. Ovary 5-lobed, 5-celled; styles distinct, with capitate stigmas; ovules numerous in each cell. Fruit oblong, fleshy, indehiscent. Seeds 2-5 in each cell, with or without arillus; embryo straight, with thin foliaceous cotyledons in a fleshy albumen.

Leaflets ovate, acuminate, 2-5 pair; fruit acutely angled; seeds arillate . . . . 1. *A. Carambola.*
Leaflets oblong, acuminate, 5-12 pair; fruit obtusely angled; seeds without arillus . . . . . . 2. *A. Bilimbi.*

1. **A. Carambola,** Linn.; Roxb. Fl. Ind. ii. 450; W. & A. Prodr. 141.—Sans. *Karmara, karma-ranga.* Vern. *Kamaranga.*

A tree, with close, thick-set, drooping branches; leaflets subopposite, pale beneath, glabrous or slightly pubescent, ovate, acuminate, 2-5 pair; petiolules short, pubescent. Flowers small, variegated with white and purple, in panicles, generally axillary, sometimes from the old wood. Calyx glabrous. The 5 shorter stamens usually very minute, and wholly without anthers, or occasionally 1 or 2 of them longer, with small brown anthers. Fruit obovoid-oblong, 3 in. long, with acute angles, yellow. Funicle of seed dilated into a fleshy, bilabiate, irregularly-cut arillus.

Native country unknown, probably in the Indian Archipelago. Cultivated on account of its fruit for ages in tropical and subtropical India, as far north as

Lahore. Produces fruit at Hoshiarpur. Fl. H. and R.S. Fruit C.S. Two varieties cultivated in Bengal, one with acid, the other with sweet fruit. The leaves are sensitive.

2. **A. Bilimbi**, Linn.; Roxb. ii. 451; W. & A. 142; Bedd. Fl. Sylv. t. 117.—Vern. *Bilimbi, belambu, blimbu, anvalla.*

A small tree; leaflets subopposite, pubescent, oblong, acuminate, 3 in. long, 6-14 pair, on short pubescent petiolules. Flowers ½ in. long, dark brownish purple, in panicles on the old wood of stem and branches. Calyx and branches of inflorescence with dense ferruginous pubescence. All stamens generally antheriferous. Fruit oblong, 2 in. long, with obtuse angles, yellow. Seeds without arillus.

Cultivated and run wild in tropical India. Native country unknown. Fl. H.S. Fr. R.S. Fruit acid, pickled or preserved with sugar.

ORDER XVII. **RUTACEÆ.**

Shrubs or trees, rarely herbs, generally aromatic, with alternate or more rarely opposite, compound or simple exstipulate leaves, dotted with translucent glands. Sepals 4-5, free or connate. Petals same number as sepals, hypogynous or perigynous. Stamens as many, or twice as many, as petals; anthers generally versatile, 2-celled. Disc annular, cylindrical or elongated, between stamens and ovary. Carpels 4-5, mostly connate. Seeds oblong or reniform, with or without albumen; embryo large; cotyledons fleshy or foliaceous.—Gen. Pl. i. 278; Royle Ill. 129, 157; Wight Ill. i. 104, 165 (*Aurantiaceæ, Zanthoxyleæ*).

Carpels more or less distinct; flowers unisexual	1. ZANTHOXYLUM.
Carpels connate; ovules 1-2 in each cell.	
Petals imbricate; stamens 8-10.	
Style deciduous; leaves imparipinnate.	
Thorny shrubs; leaflets opposite; common petiole winged	2. LIMONIA.
Unarmed shrubs; leaflets alternate or subopposite; common petiole terete.	
Stamens 10; filaments subulate; leaflets alternate .	3. MURRAYA.
Stamens 8-10; filaments dilated; leaflets subopposite	4. CLAUSENA.
Style short, persistent; leaves 1-5 foliolate . . .	5. GLYCOSMIS.
Petals valvate; stamens 4-5	6. SKIMMIA.
Carpels connate; ovules numerous.	
Leaves simple; stamens 20-60	7. CITRUS.
Leaves imparipinnate; stamens 10-12	8. FERONIA.
Leaves trifoliolate; stamens 30-60	9. ÆGLE.

Toddalia aculeata, Pers.; Wight Ill. t. 66; syn. *Scopolia aculeata*, Roxb. Fl. Ind. i. 616,—is a thorny scandent shrub, with 3-foliolate leaves, and orange-coloured pungent berries, 5-grooved and 5-seeded. South India, Kamaon (*Kanj*), found by Madden in Mairwara (*Dahan, lahan*).—As. Soc. Journ. xvii. pt. i. 404.

1. **ZANTHOXYLUM**, Linn.

Leaves alternate, imparipinnate. Flowers unisexual. Calyx 3-5-lobed, imbricate. Petals 3-5, or none. Male flowers: stamens 3-5, round a rudimentary ovary; anthers versatile. Female flowers: carpels 1-5, oblique, 1-celled, 2 ovules in each cell; styles lateral. Fruit-carpels distinct, 1-5, dry or drupaceous, 1-seeded, splitting in 2 valves. Seeds with a filiform funicle, and black crustaceous testa, often covered by a thin fleshy epidermis; albumen fleshy, enclosing a straight or curved embryo, with round, flat, foliaceous cotyledons.

1. **Z. alatum**, Roxb. Fl. Ind. iii. 768.—Syn. *Z. hostile*, Wall. Vern. *Tīmbūr, tīmūr, sīmūr, tīmru, darmar, tīrmal, tezmal, tezbal, tīswal.*

Aculeate, with strong, smooth, nearly straight prickles on branches, petioles, and midrib of leaflets, the prickles on branches often surrounded at the base by a ring of cork; 2 prickles at the base of petiole in the place of stipules. Leaves alternate, imparipinnate; common petiole winged; leaflets opposite, mostly 2-4 pair, sessile, lanceolate, more or less indistinctly serrate, pellucid-punctate. Flowers small, yellow, on lateral panicles; peduncles and pedicels pubescent; bracts small. Calyx with 6-8 acute segments. Petals none. Filaments 6, 7, or 8, much longer than calyx. Fruit-carpels 1, 2, or 3, reniform or ovoid, on short stalks, reddish, of the size of a small pea when fresh.

Outer Himalaya, from the Indus to Bhutan, ascending to 6000 ft., Kasia hills. In the N.W. Himalaya chiefly in hot valleys. Fl. April-July; fruit ripens Aug.-October.

Usually a shrub, at times a small tree 20 ft. high, with a short, straight trunk 2 ft. girth, short, stiff, bushy branches, forming a small roundish thin head of dark-green foliage. Every part of the plant possesses a peculiar aromatic pungency. Bark of larger branches thin, dark brown, even, scabrous, with small white specks, that of the trunk cinereous and smooth. Wood whitish, close, even-grained, hard, heavy, strong, used for walking-sticks and clubs. Tooth-brushes are made of the branches. The aromatic pungent fruit is used as a remedy for toothache, and as a condiment; bruised, it is put into unwholesome water to make it good. The bark is used for intoxicating fish.

Z. oxyphyllum, Edgew. Trans. Linn. Soc. xx. 42, a straggling shrub, often climbing over tall forest-trees, has larger leaves; leaflets 6-8 pair, serrate; common petiole not winged; flowers in compact terminal panicles, shorter than leaf. Carpels red, ½ in. diam., often 4 ripening. Garhwal. Kamaon. Nepal. Sikkim. Kasia. Shady forests, 6000-8000 ft.

Zanthoxylum Clava Herculis, Linn., the prickly yellow wood of Jamaica, is a large West Indian timber-tree with beautiful close-grained wood, used for furniture and inlaid-work.

2. LIMONIA, Linn.

Leaves alternate, imparipinnate or 3-foliolate; leaflets opposite. Flowers bisexual. Calyx 4- or 5-cleft. Petals 4 or 5, oblong, imbricate. Stamens 8 or 10, free; filaments subulate; anthers versatile. Ovary 4-5-celled, on an annular or elongated disc; style deciduous; ovules 1 or 2 in each cell. Fruit baccate, 1-4-celled; seeds 1-4, surrounded with mucilage; embryo straight; radicle short, conical; cotyledons fleshy, plano-convex; albumen none.

1. **L. acidissima**, Linn.; W. & A. Prodr. 92.—Syn. *L. crenulata*, Roxb. Cor. Pl. t. 81, Fl. Ind. ii. 381. Vern. *Beli*, North-West Prov.

Glabrous, armed with straight thorns ½ inch to 1 inch long, mostly axillary. Leaves alternate, imparipinnate; common petiole broadly winged, foliaceous; leaflets commonly 5 to 9, sessile, ovate-lanceolate, like the wings of the petiole crenate and pellucid-punctate. Flowers white, fragrant, in short axillary racemes, frequently bearing 1 or 2 leaves. Calyx 4-cleft. Petals 4, oblong, more than twice the length of calyx, pellucid-punctate. Stamens 8, nearly equal. Ovary oblong, obtuse, 4-celled; ovules 1 in each cell, pendulous; stigma capitate, obtuse. Berry globose, fleshy, black when ripe, less than ½ inch diam.; seeds 1-4.

Outer Himalaya, from the Sutlej to Garhwal, ascending to 4000 ft. Assam. Bengal. South India. Hardy in England. Fl. April, May.

A shrub 8 to 10 ft. high; in favourable conditions a small tree 16 to 18 ft., with a short trunk 18 in. girth, and a small, elegant oval head. Bark cinereous, rugose: wood yellow, very handsome, hard, close-grained, worthy of attention for the lathe; used for axles of oil-presses, rice-pounders; good fuel. Pulp of fruit flesh-coloured, exceedingly acid; an article of commerce in Malabar; considered protective against contagion, and an antidote to venomous poisons.

3. **MURRAYA**, Linn.

Unarmed shrubs or trees. Leaves alternate, imparipinnate, with alternate leaflets. Flowers bisexual. Calyx 5-cleft. Petals 5, free, imbricate. Stamens 10, free; alternate shorter, filaments subulate. Ovary on a more or less elongated disc, 2-5-celled, attenuated into the style, which is eventually deciduous; ovules 1 or 2 in each cell. Fruit a 1-2-seeded berry. Seeds without albumen; cotyledons plano-convex.

Nearly glabrous; leaflets usually 5-7 . . . 1. *M. exotica.*
Pubescent, leaflets usually 10-25 . . . . 2. *M. Kœnigii.*

1. **M. exotica**, L.; Roxb. Fl. Ind. ii. 374; W. & A. Prodr. 94; Wight Ic. t. 96.—Syn. *M. paniculata*, Jack; Dalz. & Gibs. Bombay Fl. 29. Vern. *Kamini*, Beng.; *Marchula*, *juti*, Kamaon.

A shrub or small tree, evergreen, with ash-coloured bark; glabrous, or young parts pubescent. Leaflets usually 5-7, shortly petiolulate, ovate or obovate, entire, frequently oblique at base, 1-2 in. long, thinly coriaceous and shining. Flowers white, fragrant, in short terminal and axillary corymbs. Petals linear or cuneate, many times longer than calyx. Ovary linear, 2-celled; style filiform; stigma capitate. Berries red, acuminate at both ends, 2-seeded. Varies with many-flowered corymbs, and with few, sometimes solitary flowers.

Outer Himalaya from the Jumna to Assam, ascending to 4500 ft., hilly parts of the Oudh forests, Behar, South India, and Burma. Wood close-grained, hard, white, has been used for wood-engraving. Cultivated in gardens throughout India. Fl. May-Sept. Fr. Oct.-Feb.

2. **M. Kœnigii**, Sprengel.—Syn. Bergera Kœnigii, Linn.; Roxb. Fl. Ind. ii. 375; Cor. Pl. t. 112; W. & A. Prodr. 94. Vern. *Gandla*, *gandela*, *gāndla*, *gāndi*, *gānt*, *gani*, *bowāla*, Pb., N.W.P.; *Harri*, *Kat-nīm*, Oudh; *Barsanga*, Beng.

Pubescent. Leaflets 10-25, oblique at base, ovate-lanceolate, short-petiolulate, about 1 in. long. Flowers white, in terminal corymbose panicles. Calyx persistent; segments short, triangular. Petals oblong, dotted, 4-5 times longer than calyx. Anthers short, cordate. Ovary 2-celled; style short, cylindrical; stigma capitate, sulcate. Fruit ovoid, black when ripe, surface rugose; seeds embedded in mucilaginous fluid.

Outer Himalaya, from the Ravi to Assam, ascending to 4000, sometimes to 5000 ft.; Oudh, Gorakhpur, not common in the Central Provinces. Common in Bengal and South India. Leaves renewed in March and April; fl. from April onward; fruit ripens June-January. Fruit aromatic, astringent; pulp with a subacrid white juice.

A small, elegant tree, 12-15 ft. high, with a short trunk to 18 in. girth, a round, close, shady crown, with bright green foliage. All parts of the plant have a peculiar, powerful, rather disagreeable, aromatic odour, whence most of the native names. Bark thin, purplish brown, smooth, partly reticulate, the old bark exfoliating in flat, nearly 4-sided, hard scales. Wood close-, even-grained, hard, durable, employed for agricultural implements. Cultivated for the sake of its leaves, which are used to flavour curries.

4. CLAUSENA, Burm.

Unarmed shrubs or trees, with alternate, imparipinnate leaves. Flowers bisexual. Calyx 4-5-toothed, or -lobed. Petals 4-5, free, slightly imbricate. Stamens 8-10, free; filaments dilated. Ovary on a short raised torus, 2-5-celled; style at length deciduous; ovules 2 in each cell. Fruit a 1-5-celled and -seeded berry.

1. **C. pentaphylla,** DC.—Syn. *Amyris pentaphylla,* Roxb. Fl. Ind. ii. 247. Vern. *Rattanjote, surjmukha,* Khyrigarh; *Teyrūr,* Gonda (Oudh).

A deciduous shrub, extremities silky tomentose; full-grown leaves pubescent. Leaflets 5-7, leaflets subopposite or alternate, ovate or ovate-lanceolate, acuminate, 4-6 in. long, short-petiolulate. Main lateral nerves prominent, numerous, anastomosing by conspicuous intramarginal veins. Flowers yellowish, in terminal, hairy cymose panicles. Berry ovoid, verrucose, pale orange, ⅓-½ in. long.

Sub-Himalayan tract, Kamaon, and Nepal. Sāl forests of the Doons and of Oudh. Fl. April, May. Fruit ripens Nov. The bruised leaves are highly aromatic.

5. GLYCOSMIS, Correa.

Unarmed shrubs or trees with imparipinnate or unifoliolate leaves. Flowers bisexual, small. Calyx 5-partite. Petals 5, free, imbricate. Stamens 10, free, alternately shorter. Ovary sessile, or on a very short stipe, with 5 (or fewer) cells; ovules solitary; style very short and thick, continuous with the ovary, persistent. Fruit 1- or few-seeded.

1. **G. pentaphylla,** DC.; W. & A. Prodr. 93.—Syn. *Limonia pentaphylla,* Roxb. Cor. Pl. t. 84; Fl. Ind. ii. 381. Vern. *Ban-nimbu* (*wild lemon*), *pilru potala,* N.W.P.; *Girgitti,* Oudh; *Kirmira,* Bomb.

A small, evergreen, erect shrub, wholly glabrous, exceedingly variable in its foliage. Leaves generally with 3-5 leaflets, often unifoliolate; lateral leaflets alternate or subopposite. Leaflets ovate-lanceolate, ovate or obovate, acuminate, 4-12 in. long, penninerved; main lateral nerves distinct, but not prominent, joined by inconspicuous intramarginal veins. Flowers white, fragrant, in erect terminal or lateral panicles. Berries subglobose, white, pink, or blue, somewhat compressed, ⅓ in. across.

Common in South India, Ceylon, Burma, Bengal. Oudh forests, forming thick undergrowth in parts. The ripe fruit is eaten. Fl. spring, autumn, and nearly throughout the year.

6. SKIMMIA, Thunberg.

1. **S. Laureola,** Zuccarini.—Syn. *Limonia Laureola,* Wall. Pl. As. rar. t. 245; *Anquetilia Laureola,* Jacquem. Voy. Bot. t. 161. Vern. *Ner, barru,* Pb. *Nehar, gurl pata,* Kamaon.

A small, wholly glabrous, shrub; leaves alternate, lanceolate or oblanceolate, coriaceous, entire, often approximate near the ends of branches, midrib prominent, without conspicuous secondary nerves. Flowers white, in erect, compact, terminal panicles. Drupes subglobose, ⅓ in. across.

Himalaya, Indus to Bhutan, alt. 5000-11,000 ft. Afghanistan. Fl. April, May. Fruit Oct. The leaves have an orange-like smell when crushed.

7. CITRUS, Linn.

Evergreen shrubs or trees, armed with axillary thorns; wood close- and even-grained. Leaves alternate, simple (unifoliolate), glandular-dotted, coriaceous; petiole often winged. Flowers white, or tinged with red, sweet-scented. Calyx cup-shaped, 4-5 cleft. Petals 4-5, rarely more, thick, with glandular dots, imbricate in bud. Stamens 20-60; filaments flat, more or less connate in bundles; anthers oblong. Ovary many-celled, on a large annular or cup-shaped disc; style terete, deciduous, with a capitate, lobed stigma; ovules axile, biseriate, 4-8 in each cell. Fruit globose or oblong, succulent, indehiscent, divided into 9-15 cells by membranous dissepiments, the cells with numerous transverse vesicles, filled with sweet or more or less acid juice; the rind full of vesicles or glands, filled with aromatic essential oil. Seeds few in each cell; testa leathery; albumen none; embryo straight, with a short radicle, and thick, fleshy, oily cotyledons. Often 2 or 3 embryos in one seed.

- Young shoots and leaves perfectly glabrous; transverse vesicles of pulp concrete.
  - Young shoots purple; petals generally tinged with red; flowers often unisexual; stamens 20-40; fruit globose, ovoid or oblong, often terminated by a knob . . . 1. *C. medica.*
  - Young shoots whitish; petals white; flowers bisexual; stamens 20-30; fruit globose or flattened; pulp sweet, acid, or bitter 2. *C. Aurantium.*
- Young shoots and under side of leaves pubescent; transverse vesicles of pulp distinct . . . . 3. *C. decumana.*

C. japonica, Thunberg, *the Kumquat,* with small globose fruit and lanceolate leaves, as well as the other Chinese and Japanese species and forms, cannot be noticed here.

To this genus belong the *Citron, Lemon,* the sweet and acid *Lime,* the sweet and bitter *Orange,* the *Bergamot,* and the *Shaddock,* most of which are cultivated in India, and some of which are found wild in the forests of the outer Himalayan valleys, in Sikkim, Kamaon, and Garhwal, in the Kasia hills, the Western Ghats, on the Pachmarhis in the Satpura range, and in Burma. The great multitude of forms of this widely cultivated genus has probably arisen from two or three distinct species, and the study of the wild forms of Oranges and Limes in India may throw some light upon the origin and history of the cultivated kinds. At present it seems most convenient to class the wild and cultivated forms under the three species defined above; but further researches may eventually alter the number of species, and modify their limits and characters. These researches should, however, comprise not only the apparently indigenous forms, and those cultivated in Europe and India, but equally the large variety of Oranges cultivated in China, Japan, and Polynesia.

A few introductory remarks regarding the classification of this genus may not be out of place. Linnæus established two species, *C. medica*, with linear petioles, comprising the Lime, Lemon, and Citron; *C. Aurantium*, with winged petioles, comprising the sweet and bitter Orange and the Shaddock. From these Willdenow separated the Shaddock, *C. decumana;* and Roxburgh, Fl. Ind. iii. 390, added *C. acida*, under which name he described the acid Lemons and Limes, and the sweet Limes of India with winged petiole, which therefore could not be classed under *C. medica* of Linnæus. *C. inermis*, the small unarmed Orange of China, he added as a separate species. About the time that Roxburgh wrote his 'Flora Indica,' the history and classification of the cultivated Oranges was the subject of careful researches by two botanists in the south of Europe. Georges Gallesio, Sous Préfet of Savona, published in 1811 a small octavo volume (Traité du Citrus) containing the results of most valuable studies and observations made by him in the district of Finale, between Nice and Genoa, on the Riviera di Ponente. Gallesio establishes 4 species (*Citron*, *Lemon*, *sweet* and *bitter Orange*), to which he refers, either as varieties or as hybrids, all forms known to him. A few years later—in 1813—A. Risso, Professor of Natural Sciences at the Lyceum of Nice, published in the 20th volume of the 'Annales du Muséum d'Histoire Naturelle,' his "Mémoire sur l'histoire naturelle des Orangers, cultivés dans le Département des Alpes Maritimes." His classification agrees in the main with that of Gallesio, but he adds the *sweet Lime* (*C. Limetta*) as a 5th species: and in a subsequent work which appeared in 1819, with magnificent illustrations (Risso et Poiteau Histoire Naturelle des Orangers), 8 types or races are described: 1. *C. Aurantium*, the sweet Orange; 2. *C. Bigaradia*, the bitter Orange; 3. *C. Bergamia*, the Bergamot; 4. *C. Limetta*, the sweet Lime (with white flowers); 5. *C. decumana*, the Shaddock; 6. *C. Lumia*, the sweet Lemon (flowers tinged with red); 7. *C. Limonum*, the Lemon; and 8. *C. medica*, the Citron. This classification has been adopted in many standard works. A. Décandolle, however, in his 'Géographie Botanique raisonnée' (1855), 871, expresses his opinion that the principal forms may be reduced to 3 species, *C. medica*, *C. Limonum*, and *C. Aurantium*, with the addition, as a doubtful species, of the Shaddock. This arrangement is carried out in Lowe, 'Flora of Madeira' (1868), 71; but he adds *C. nobilis*, Lour., comprising the sweet Oranges with loose skin (the Tangerine and Mandarin Orange), as a separate species. Grisebach, in his 'West Indian Flora' (1864), 132, reverts to the three original species, *C. medica*, *Aurantium*, and *decumana;* and this is the arrangement which I have here adopted, with some modification of the specific characters. I desire, however, to state at the outset, that the characters here set forth do not hold good in the case of all cultivated kinds classed under these three species. Some of the intermediate forms may be hybrids; and besides, it is more than probable that we have not yet arrived at the correct classification of this genus. The present arrangement, however, seems the most convenient to guide and facilitate further researches in India on this interesting subject.

1. **C. medica**, Linn. The *Citron*, *Lemon*, *sweet* and *acid Lime*. Comprises *C. medica*, *Limonum*, and *Lumia* of Risso and Poiteau.

Shrubs, sometimes trees, generally bearing flowers and fruit at all, or at most, seasons of the year. Young shoots glabrous, purple. Leaves glabrous, 3-6 in. long, oblong elliptic ovate or ovate-lanceolate; petioles naked or winged. Flowers white, generally tinged with red, small or middle-sized, often unisexual; stamens 20-40. Fruit ovoid, oblong or globose, usually yellow when ripe, skin thick or thin, with or without a knob, surface even or rough.

Wild in Burma; Chittagong (Hooker), "Sitakund hill;" Kasia (Hooker and Thomson), "foot of hills, ascending to 4000 ft.;" Sikkim (Hooker and Thomson), "hot valleys, ascending to 4000 ft., fruit like a lemon, but narrow-peaked, 2 lb. weight." Common in the Doons between Sardah and Jumna; Pachmarhi hills, in deep ravines, and here and there on the Western Ghats. The specimens of the wild Limes and Citrons in India which I have had an opportunity of examining, have oblong oblong-elliptic or oblong-obovate leaves, 3-5 in. long, edge crenate or blunt-serrate; petioles short, thick, unwinged, or longer, and narrow-winged; flowers in racemes of 5-20, often unisexual; number of stamens varying, generally between 20 and 30, sometimes more than 30. Fruit often knobbed. Royle, Ill. 129, mentions two forms found by him, apparently wild, in the Doons of the N.W. Himalaya: one called *Bijouri*, with the characteristics of the Citron; the other called *Behari-Nīmbu*, or *Pahari Kagūzi*, with those of the Lemon,—and which retain their difference under cultivation. Madden also, in his paper on the Terai and outer mountains of Kamaon, mentions "two species of Citrus, probably *Limonum* and *medica*, *Jamīr* and *Bijaura*."—Journ. As. Soc. xvii., pt. i. 391. Certainly there are different forms among the specimens collected by Royle, by Dr Stewart, myself, and others, in the N.-W. Himalaya; but they require further investigation on the spot: and for the present it seems more convenient to unite them all under *C. medica.*

Under this species may be classed the following cultivated kinds:—

a. THE CITRON. *Cédratier*, French; *Cedro*, Ital.; *Vijapūra*, Sans.; *Utrej*, *otroj*, Arab.; *Bejaura*, Hind.; *Begpura*, Beng. (*Karanphal*, Kamaon.) Leaves oblong; petiole short, naked or marginate; fruit large, oblong or obovoid, generally terminating in a blunt-pointed beak, or irregularly shaped; surface warty, rarely even; rind thick, very aromatic, tender; pulp scanty, subacid. Cultivated in many parts of India—Assam, Calcutta, Chota Nagpore, North-West India, Bombay; also in Persia. The Chinese place the fragrant fruit on dishes to perfume the air. Madeira and the south of Europe export candied Citron, the thick fragrant rind preserved in sugar. Lowe (Flora of Madeira) retains the Citron as a distinct species, characterised by oblong leaves, short unwinged petioles, and numerous flowers in a cluster. Mr Lowe's classification is based on long-continued study of the plants cultivated in Madeira, and it is not impossible that it may eventually be found to be correct in this respect.

b. THE LEMON. *Limonier*, more generally *Citronnier*, French; *Limone*, Ital.; *Citrone*, German; *Bara nīmbu*, Hind.; *Korna Nebu*, Beng. Leaves ovate; petioles marginate or winged; fruit middle-sized, ovoid, yellow, knobbed; rind thin; pulp abundant, very acid. Cultivated abundantly in the south of Europe. Citric acid is made of it. In Madeira the Lemon grows into a tree 20-30 ft. high, and is in flower and fruit from Oct.-May.

c. THE ACID LIME OF INDIA. *C. acida*, Roxb. l. c. 390; Ic. Roxb. in Herb. Kew. *Jambīra*, Sans.; *Limu*, *limoun*, Arab.; *Lebu*, *nebu*, *līmbu*, *nīmbu*, Beng., Hind. Leaves oval; petioles winged, many times shorter than leaf; wings linear or obovate. Flowers small, in short racemes; petals generally 4. Roxburgh describes seven varieties, of which the two small thin-skinned kinds, yellow when ripe, with an abundance of pale, sharp acid juice, are the most generally cultivated. (*Pāti Nebu*, the small round Lime; and *Kagūji Nebu*, *Kaghzi Nīmbu*, the small long Lime.) A third kind, the large acid Lime, is grown in Burma and in Bengal (*Kāmarāli-Nebu*).

d. THE SWEET LIME OF INDIA, *Mītha Nebu*. (*Amritphal*, Kamaon.) Commonly cultivated in most parts of India and Burma. Fruit globose, smooth, 3-5 in. diam., thin-skinned, with an abundance of sweet, not aromatic, juice. Ripens at different seasons, but principally in summer. It is a matter for further inquiry whether all kinds of Indian sweet Limes should be referred to this species The sweet Limes cultivated in France and Italy are referred by Risso and Poiteau partly to *C. Limetta*, with white flowers, partly to *C. Lumia*, with the flowers tinged with red. Voigt., Hort. Suburb. Calc. 142, refers the Indian sweet Lime to *C. Limetta.*

2. **C. Aurantium,** Linn. The *bitter* and *sweet Orange*, and the *Bergamot.* Comprises *C. Aurantium*, *Bigaradia*, *Bergamia*, and *Limetta* of Risso and Poiteau.

Trees, rarely shrubs, bearing flowers and fruit generally at one season of the year only. Young shoots glabrous, greenish white. Leaves glabrous, 3-6 in. long, elliptic or ovate, acuminate; petioles naked or winged, wings often obovate, as large as the leaf, or nearly so. Flowers pure white, middle-sized, bisexual; stamens 20-30. Fruit globose, often depressed, generally orange-coloured, ripe in India generally Dec.-March.

Orange-trees have been found wild or apparently wild in the Kasia hills (Hooker and Thomson), between 4000 and 3000 ft., with globose fruit, winged and unwinged petioles, and acute or obtuse leaves; in Sikkim (Hooker and Thomson), alt. 1000 ft., with unwinged petioles, and oblong-elliptic acuminate leaves; in Kamaon (Strachey), at Bagesar, 3000 ft., with unwinged petioles; in Garhwal (Thomson), at 2000 ft., with globose fruit, naked or marginate petioles, and oblong-lanceolate acuminate leaves.

Under this species may be classed the following cultivated kinds:—

a. THE BITTER OR SEVILLE ORANGE. *C. Bigaradia*, Risso et Poiteau. *Bigaradier*, French; *Arancio forte*, Italian; *Pomeranze*, German; *Naranj*, Arab. Petiole generally winged; flowers larger and more strongly scented than those of the sweet Orange; rind of fruit very aromatic; pulp not sweet, bitter or austere. Not extensively cultivated in India. Grown in large orchards on the island of Sardinia, in Spain, and elsewhere in the Mediterranean region, mainly on account of the flowers, from which the essential oil of Oranges is distilled. In the south of Europe the bitter Orange is more hardy than the sweet Orange, and this again is more hardy than the Lemon.

b. THE SWEET ORANGE. *C. Aurantium*, Risso et Poiteau. *Oranger*, French; *Arancio dolce*, *portogallo*, Italian; *Portogallo*, Greek; *Apfelsine*, German; *Nagaranga*, Sans.; *Naranj*, Arab.; *Narangi*, *naringi*, *sangtara*, *sunthura*, *kumla nebu*, Hindi and Bengali. Petiole naked or winged; pulp sweet, yellow, sometimes red, in a loose or adhering rind. The sweet Orange does not come to perfection in all parts of India. In Lower Bengal it does not fruit at all, or does not bear freely, and the fruit is dry and austere. Calcutta is supplied from the valleys of the Kasia hills north of Silhet. Delhi, Nagpore, Aurungabad, Sautgur near Vellore, and the Northern Circars, are famous for their Oranges; but there are large tracts where none or inferior kinds only are produced. In India the fruit generally ripens between December and March, according to the climate of the locality. A variety which flowers twice a-year (Feb. and July), and yields two crops—the first from November to January, and the second crop in March and April—is grown at Nagpore (Firminger's Gardening, 2d ed., p. 223). The sweet Orange is grown in all parts of the Mediterranean region, and the fruit is largely exported from Sardinia, Sicily, the Balearic Islands, Spain, Portugal, and Madeira. On the Riviera, the cultivation, which was very extensive in the time of Gallesio, has declined; and in many cases the bitter Orange has been substituted, the flowers of this kind being more profitable there at present than the fruit of the sweet Orange. In the south of Europe the Orange attains a much larger size than in India. A yield of 3000 to 5000 Oranges per tree annually is not rare. Near Milis, on the island of Sardinia, there are trees more than 6 ft. in girth, said to be 700 years old. The wood of the Orange is hard, close-, and even-grained, yellowish, weighs 49 lb. when seasoned, and 65-70 lb. when green (Skinner). In South Europe it is used for turning, engraving, inlaid and cabinet work, and excellent walking-sticks are made of shoots and branches.

In favour of considering the sweet and bitter Orange as distinct species, the fact has been urged that in some districts in the south of Europe the seed of the sweet Orange always reproduces its own kind without grafting. Regarding the fact there seems to be no doubt; Gallesio affirms it as the result of his researches and of direct experiments, and his statements are confirmed by other information of a later date. Gallesio states (l. c. p. 32), that during a series of years he had sown the seeds of the sweet Orange; that they never produced bitter Oranges; and that during a period of 60 years no instance was known to the practical gardeners of the Finalais of a bitter Orange having been produced from the seed of a sweet Orange-tree, or a sweet Orange having arisen from the seed of a Bigaradier. In the last chapter of his book he relates how, in the severe winter of 1709, all Orange-trees in Liguria were killed; and how, to replenish the gardens, nurseries were formed with the seed of the sweet Orange. The trees thus raised were grafted according to old custom, but severe frost recurred in subsequent years, and many of the grafts were killed. Some of the trees were regrafted; others were left alone, and these were found to produce excellent fruit. This discovery was followed up; and the result was, that the old custom of grafting was abandoned in many parts of the Riviera. At present the sweet Orange is often grafted on the bitter Orange stock, because the latter is more hardy, and because grafted trees come into bearing more quickly than seedlings (*arbres francs*); but as far as our knowledge goes, there seems no doubt that on the Riviera, at least, the seed of the sweet Orange reproduces its own kind. As far as I have been able to ascertain, the sweet Orange-trees in the vast orchards of the Kasia valleys are all raised from seed without grafting. On the other hand, there seems no doubt that in America the matter is often different. On the island of Guadalupe the seed of the sweet Orange produces bitter fruit; and in Caracas, *Naranjo agrio* is the term for an austere kind, often produced from the seed of sweet Oranges (Ernst, plants cultivated or naturalised in the valley of Caracas, Seemann Journ. Bot. v. 272). Macfadyen, in his 'Flora of Jamaica' (1837), p. 129, states that the seed of the sweet Orange frequently grows up into a tree bearing the bitter fruit. It is clear, then, that the question, whether the sweet and bitter Orange are specifically distinct, derives no support from these facts either way, and that it must be decided on other grounds. The case is similar to that of the Mango in India. In Burma, and I believe also in other parts of India, the seed of certain good varieties produces fruit of a similar kind without grafting; whereas, apparently, in a climate or under circumstances somewhat less favourable, ungrafted trees, as a rule, bear nothing but inferior fruit, more or less stringy and turpentiny. The matter is one well worthy of further research in India. As matters stand at present, there does not seem sufficient ground for considering the sweet and bitter Orange as distinct species.

c. THE BERGAMOT. *C. Bergamia*, Risso et Poiteau. Flowers small, very sweet-scented; fruit pear-shaped or globose; rind smooth, pale yellow; pulp acidulous, with a pleasant aroma. Not, as far as I know, cultivated in India. Bergamot oil is the volatile oil of the rind. Voigt, l. c. 142, refers to this the *acid Limes* of India, but they certainly have more the character of *C. medica*.

d. THE ACID LIME OF THE WEST INDIES (*C. Lima*, Macfadyen; *C. acidis-*

sima, Meyer) is referred by Grisebach, l. c., to *C. Aurantium.* It is described as a thorny shrub or small tree of shrubby growth; leaves oval; flowers white, pentamerous; stamens 25, rarely 30. Fruit nearly globose, small, yellow when ripe, with a thin skin, and an abundance of pure acid juice. In Jamaica it is quite naturalised, and forms strong fences; lime-juice and citric acid are made from the fruit. The fruit is much like the *small acid Lime* of India, and it is a matter for further inquiry whether it should be classified under *C. Aurantium.* Lowe classes the West Indian Lime grown in Madeira (*Limaō de Gallinha*, Port.) under *C. Limonum.* Others have classed the West Indian Lime under *C. Limetta*, Risso.

3. **C. decumana**, Willd. *The Shaddock, Pumelo, Pomplemoes.*—Vern. *Batavi Nebu, maha nīmbu, chakōtra.*

A tree, attaining 30-40 ft.; young shoots pubescent. Leaves large, 6-9 in. long, oval-oblong, pubescent beneath, frequently emarginate; petiole broad-winged. Flowers white, large; stamens 16-24. Fruit large, pale yellow, globose or pear-shaped; rind thick; pulp pale yellow pink or crimson, sweet or acrid; transverse vesicles distinct.

Introduced into India from Java. Seemann, Flora Vitiensis, p. 33, states that it apparently is indigenous in Polynesia. Cultivated in most tropical countries.

The history of the gradual spread of the species of this genus is remarkable. The Citron alone is described by classical writers. It was cultivated in Media and Persia long before the conquests of Alexander the Great. The Greek botanist Theophrastus, who wrote shortly after Alexander's death, gives a description of the tree and its fruit which cannot be mistaken. They were called Median and Persian apples, and valued highly on account of their strong aromatic scent, as antidotes against poison, and to make the breath sweet. In Greece and Italy the tree does not appear to have been cultivated much before the third century of our era, although the fruit was imported at a much earlier date. Plinius mentions its use in Rome, and in his books the name Citrus first occurs. In the fifth century it was cultivated in the island of Sardinia, and about Naples. On the coast of Mentone and Hyeres it was, according to Gallesio, introduced in the twelfth or thirteenth century.

Oranges and Lemons are not mentioned in the works of Greek and Roman authors. The first notice regarding them is found in Arab books of the tenth and eleventh century; and it seems certain that the Lemon and the bitter Orange were brought from India to Arabia, Syria, and Egypt in the ninth or tenth century, and that their introduction in South Europe was mainly due to the progress of Arab conquest, in some cases to the Crusaders, and to the trade connections between the Italian ports and the East. The bitter Orange was extensively cultivated in Sicily and in Spain in the twelfth century. In Italy and the south of France, Oranges and Lemons were not commonly grown before the fourteenth century.

The sweet Orange was introduced in Europe at a much later date; and it cannot yet be considered as finally decided whether it came by way of Syria—which, however, seems probable—or whether the Portuguese may claim the honour of having imported it by sea from India or China. So much is certain, that on landing in India the Portuguese found sweet Oranges in abundance; this fact is specially noted in the account of Vasco de Gama's voyage.

A comparison of the European, Sanskrit, and Arabic names of the Citron, Orange, and Lemon, confirms the result of historical research regarding the spread of their cultivation. The Sanskrit name of the Citron, *Vījapūra*, never went far West. At the time of Alexander the Great, the fruit was known under the name of Persian and Median apples, and was afterwards called Citrus, the Latin term for κέδρος, by which the *Cedar*, *Juniper*, and other aromatic and resinous coniferous woods, were designated, which, like the Citron, had the property, or were supposed to possess the property, of keeping away insects. On the other hand, the words *Limone*, *Lime*, *Lemon*, evidently derive their origin from the Arab *Limu;* and this name probably has a Sanskrit origin. The Sanskrit word *Nagaranga*, for Orange, is readily traced in the Arab *Naranj*, and the European terms *Aranzio*, *Pomeranze*, *Orange*. Again, the word *portogallo*, by which the sweet Orange is known in parts of the Mediterranean region —for instance, in Greece and Albania—is quoted in proof of the introduction of this fruit by the Portuguese, in the same way as the German (and Russian) term, *Apfelsine*, seems to point to its having been brought from China.

So far regarding the westward spread of these fruits. Whether the numerous varieties of Citrons and Oranges cultivated in China have originated in species indigenous in that country, or whether the mountains of India are their original home, and whether any fruit-trees of this genus are indigenous in the Indian Archipelago or in Polynesia—these are questions of great interest, which call for further botanical and historical studies. My object in bringing these questions forward prominently in this place is to induce others with more leisure and more opportunities of observation to study a subject of great historical interest, which may eventually serve to bring out important results regarding the spread and changes of arborescent species under cultivation.

8. **FERONIA,** Correa.

Leaves alternate, imparipinnate. Flowers frequently unisexual. Calyx small, 5-dentate, deciduous. Petals 5, rarely 4-6, oblong-lanceolate, imbricate. Stamens 10-12; filaments subulate from a broad, densely villous base; anthers linear-oblong. Ovary 5-celled, or 1-celled owing to the slight cohesion of the axile placentæ, continued into a thick oblong or cylindrical style; ovules numerous, crowded in several series. Fruit globose, 1-celled, filled with pulp, with a hard rind. Seeds numerous, oblong, flat; cotyledons thick, fleshy.

1. **F. Elephantum,** Correa; Roxb. Cor. Pl. t. 141; Fl. Ind. ii. 411; Wight Ic. t. 15; W. & A. Prodr. 96. *Elephant-* or *Wood-Apple.*—Sans. *Kapittha.* Vern. *Bilin*, *kait*, *kaitha*, *katbel.*

Glabrous, armed with strong, straight, axillary thorns. Leaflets 5-7, cuneate or obovate, crenate at the top. Flowers of a dull-reddish colour, in loose, lateral, or terminal leaf-bearing panicles; axis and branches pubescent, male and bisexual flowers frequently on the same panicle. Fruit globose, 2½ in. diam.; rind hard, woody, outside rough, grey-coloured; seeds embedded in a fleshy, edible pulp.

Wild in South India; in the Outer Himalaya and Siwalik tract, ascending to 1500 ft., and extending west as far as the Ravi. Cultivated, and occasionally wild, throughout India, but not in the plains of the Panjab. Fl. Feb.-May; the fruit ripens about Oct., and often remains long on the tree.

A moderate-sized tree, with a symmetrical trunk, 2-4 ft. in girth, bearing an elegant oval head; leaves with a slight smell of aniseed. Bark dark grey or nearly black, wrinkled, corrugated with longitudinal shallow furrows. Wood yellowish or light brown, with distinct medullary rays, close-, even-, fine-grained, strong, hard, 50 lb. per cub. ft., 62-65 lb. when green. Value of P. 587-660 (Cunningham); 645 (Skinner). Used for housebuilding, naves, oil-crushers, and agricultural implements. Too coarse for engraving, but well adapted for ornamental carving. The sapwood often eaten by beetles. A white transparent gum exudes from the bark, which is collected, and forms part of the East Indian Gum-Arabic of commerce, together with the gum of the *Nīm, Mango, Babul, Seriss, Khair, Bahera,* and several other trees. Pulp of the fruit acid; a jelly is made from it.

9. **ÆGLE,** Correa.

Leaves alternate, trifoliolate; leaflets pellucid-punctate. Flowers bisexual. Calyx small, 4-5-dentate, deciduous. Petals 4-5, imbricate. Stamens numerous, with short subulate filaments, and long linear anthers. Ovary on cylindrical disc, with a thick fleshy axis, and 10-20 small cells near the circumference, with numerous ovules in each cell attached to the central angle. Stigma capitate, obtuse, deciduous. Fruit globose, with a hard woody rind, 8-16-celled, filled with an aromatic pulp. Seeds numerous, oblong, flat; testa woolly, covered with a viscid fluid.

1. **A. Marmelos,** Correa; Roxb. Cor. Pl. t. 143; Fl. Ind. ii. 579; Wight & A. Prodr. 96; Wight Ic. 16; Bedd. Fl. Sylv. t. 161. The *Bael* tree.—Sans. *Bilva, malura.* Vern. *Bel, bil, bila, bili.* Local name, *Mahaka-marra,* Gonds., C.P.; *Ushitben,* Burm.

Glabrous, armed with axillary, straight, strong, sharp spines, 1 in. long or more. Leaflets 3, rarely 5, ovate-lanceolate, crenate, terminal long-petiolulate, lateral nearly sessile. Flowers greenish white, with a fine honey scent, on short lateral panicles; pedicels and calyx pubescent. Calyx flat, teeth indistinct. Petals oblong, coriaceous, thickly dotted. Filaments occasionally fascicled. Fruit globose, oblong, or pyriform, 2 to 5 in. diam., with a smooth, grey or yellow rind, and a thick, orange-coloured, sweet, aromatic pulp.

Wild in the Siwalik tract and Outer Himalaya, ascending to 4000 ft., from the Jhelam to Assam; also in Oudh, Behar, Bengal, Central and South India and Burma. Often gregarious when wild. Cultivated throughout India, except in the northern part of the Panjab; frequently planted near Hindoo temples. Leaves shed about March and April; the new foliage appears in April and May. Fl. about May; and fruit ripens in Oct., Nov., remains long on the tree.

When cultivated, a middle-sized tree to 35 ft. high, with a short, erect, often fluted, irregularly-compressed, and scooped-out trunk, attaining a girth of 7 ft.; branches few, extremities often drooping, forming a narrow oval head. Wild (in N.W. India) generally a small, scrubby tree. Bark of trunk and larger branches ½ in. thick and more, outside soft, corky, light-cinereous or bluish grey, with large dark stains, and irregular, longitudinal, shallow furrows. Wood light-coloured, mottled with darker wavy lines and small light-coloured dots. Medullary rays indistinct. Even-, close-grained, 40-50 lb. per cub. ft. The tree being valued for its fruit, is not often felled; but the timber is esteemed for strength and toughness. Used in construction, for pestles of oil- and sugar-mills, naves and other parts of carts, and for agricultural implements. Twigs and leaves are lopped for cattle-fodder. The tenacious pulp of the fruit is used medicinally in diarrhœa and dysentery, as sherbet, and as a conserve (Pharm. Ind. 46). Dry, it keeps well as a hard, transparent substance. It is also considered an excellent addition to mortar, especially in building wells. Snuff-boxes are made of the shell of the fruit; the leaves, root, and bark are used in native medicine; from the flowers a scented water is distilled.

ORDER XVIII. **SIMARUBEÆ.**

Shrubs or trees, with bitter bark, pinnate leaves without stipules, and simple hairs. Flowers small, generally unisexual, regular. Calyx 3-5-cleft. Petals 3-5. Stamens hypogynous, inserted at the base of disc, as many as petals, or double the number; filaments free; anthers 2-celled, bursting longitudinally. Carpels more or less distinct, rarely connate throughout; ovary 1-5-celled, generally one ovule in each cell. Fruit-carpels 1-seeded.—Gen. Pl. i. 306; Royle Ill. 157 (Zanthoxyleæ); Wight Ill. i. 165, 169, 170.

Stamens twice as many as petals.
  Fruit of 1-5 flat foliaceous samaræ; leaves pinnate . . 1. AILANTHUS.
  Fruit a 1-seeded drupe; leaves 2-foliolate . . 2. BALANITES.
Stamens as many as petals; leaves pinnate . . 3. PICRASMA.

1. **AILANTHUS,** Desfontaines.

Large trees, with alternate pinnate leaves approximate near the ends of branches. Flowers polygamous, in large axillary panicles. Calyx small, 5-cleft; lobes imbricate. Petals 5, spreading, induplicate-valvate in bud. Male flowers: stamens 10, inserted at the base of disc. Female flowers: stamens none; carpels 2-5, distinct, laterally compressed, 1 ovule in each; styles as many as carpels. Bisexual flowers with 2-3 stamens. Fruit consisting of 1-5 flat, membranous, reticulate, linear-oblong samaras, each with one flattish seed in the middle. Seed with scanty albumen, flat, foliaceous, orbicular cotyledons, and a superior radicle.

1. **A. excelsa,** Roxb. Cor. Pl. t. 23; Fl. Ind. ii. 450; W. & A. Prodr. 150; Wight Ill. t. 67.—Sans. *Aralu.* Vern. *Arūa,* South Meywar; *Maruk,* Bomb.

A large tree, leaves abruptly pinnate, more or less tomentose, commonly 8-12 in., sometimes 2-3 feet long; leaflets nearly opposite, 8-14 pair, ovate from a very unequal base, often broadly falcate-lanceolate, deeply serrate, often lobed. Flowers yellowish, in axillary panicles, shorter than leaves. Petals glabrous, ovate. Filaments glabrous, shorter than anthers. Samaræ lanceolate, pointed at both ends, with numerous prominent parallel nerves. (Roxburgh figures filaments longer than anthers.)

Indigenous in Central and South India, and extensively planted throughout India as far north as Saharanpur. Leafless during the early part of the cold season, the new leaves appear in March, April. Fl. April, May. Easily propagated by seed and cuttings. 60 to 80 ft. high, bark grey, wood soft, white, not much used, except to make floats for fishing, pith large.

A. glandulosa, Desf., which is at home in Japan (perhaps also in China), and cultivated in Europe, differs by filaments longer than anthers, hispid at the base, and petals woolly tomentose inside. The leaflets, which are often 4 in. long, have generally 1-3 pair of rounded glandular teeth near the base. Grows rapidly, throws up abundant root-suckers, and has on that account been employed in plantations made to clothe barren, stony hills in the south of France. Hardy in England. Bedd. Fl. Sylv. t. 122; Wight Ic. 1604.

A. malabarica, DC., a large tree of the Western Ghats, with thick rough bark, is characterised by glabrous leaves; leaflets lanceolate, entire; filaments glabrous, longer than anthers, and a linear-oblong samara, rounded at both ends; yields a resin, *matti pāl*, used in medicine and as incense (Pharm. Ind. 50).

2. BALANITES, Delile.

Shrubs or small trees, usually armed with axillary or supra-axillary spines; leaves 2-foliolate; leaflets entire, coriaceous. Flowers bisexual; sepals and petals 5. Stamens 10, inserted at the base of disc; anthers dorsally affixed. Ovary globose, pilose, 5-celled, on the thick, fleshy, 10-furrowed disc; ovules 1 in each cell. Fruit a 1-seeded drupe, with a bony or crustaceous putamen. Seed without albumen; cotyledons thick, plano-convex, oblong.

1. **B. Roxburghii**, Planchon.—Syn. *B. ægyptiaca*, Wight Ic. t. 274; *Ximenia ægyptiaca*, Roxb. Fl. Ind. ii. 253. Vern. *Hingu, Ingua, Hingen, Hingot, Hingota, Ingol.*

Thorns axillary, strong, very sharp, often long, leaf- and flower-bearing; young parts pubescent, in dry localities hoary-tomentose. Leaflets lanceolate, oblong or obovate, nearly sessile, on a common petiole less than ¼ length of leaflets. Flowers small, white, or greenish white, fragrant, crowded in fascicles, axillary and along lateral branches. Sepals oval, downy, nearly as long as petals, both spreading, reflexed, and eventually deciduous. Style erect, short; stigma slightly 5-lobed. Drupe ovoid, 2 in. long, 5-grooved, covered with a light-grey dry rind, enclosing a bitter pulp with an offensive greasy smell; nut exceedingly hard, tubercled outside, 1-seeded.

Common in many parts of India, as far north as Delhi; in Rajputana, Bandelkhand, the Central Provinces, the Northern Circars, the Dekkan, and South India; grows chiefly in open dry places and on stiff clay soil. New leaves in March. Fl. in April and May. Usually a scraggy shrub, in favourable conditions a small tree, 30 ft. high, with an erect, short trunk, 2 ft. and more in girth. The roots spread far, and throw up suckers at a considerable distance from the trunk. Bark of trunk smooth, yellow or cinereous. Wood chiefly used for fuel. From the seed a fixed oil is pressed; the pulp is used to clean silk in Rajputana; the seeds, the bitter bark, and subacid leaves are employed in native medicine; the hard kernel of the fruit (filled with gunpowder) is used in fireworks.

The second species of this genus, *B. ægyptiaca*, Delile,—Boissier Fl. Orient. i. 944, Oliver Flora Trop. Afr. i. 315; Palestine, Egypt, Arabia, and tropical Africa,—has longer petioles, and the ovary lengthens out considerably after flowering. In the Indian plant the ovary swells, but remains ovoid and short. It is, however, a matter for further inquiry, whether all Indian forms belong to one species.

3. PICRASMA, Blume.

Trees, all parts very bitter, with alternate imparipinnate leaves. Flowers unisexual, in corymbose panicles. Calyx small, 4-5-dentate. Petals 4-5, ovate, valvate. Male flowers with 4-5 stamens, inserted under the disc. Carpels 3-5, distinct, on a thick disc; ovules solitary. Fruit consisting of 1-3, nearly dry, drupes; seeds with a straight embryo in a fleshy albumen.

1. **P. quassioides**, Bennett.—Syn. *Nima quassioides*, Hamilton. Vern.

Tūtāi, *tithāi*, *tithu*, *hulu*, *hulāshi*, *arkhar*, Pb. (the two last names are also used for species of Rhus).

Young parts pubescent. Leaflets opposite in 4-6 pairs, nearly sessile, ovate-lanceolate, acuminate, serrate; common petiole 5-8 in. long. Corymbs axillary, shorter than leaf. Flowers small, greenish, generally pentamerous. Sepals and petals persistent; petals five to six times as long as sepals, ovate, acute. Filaments with a thick, pilose base; anthers cordate-ovate, versatile. Drupes globose, ¼ in. long, black when ripe.

Outer Himalaya, from the Chenab to Nepal, between 3000 and 5500 ft., ascending occasionally to 8000 ft. Also in China. Fl. from April-June; the bitter fruit ripens from July-Sept. A tall, scrambling shrub; bark smooth, brownish, with white specks, very bitter, and used in native medicine as a tonic and stomachic.

ORDER XIX. OCHNACEÆ.

Shrubs or trees, with alternate, simple, glabrous, stipulate leaves. Flowers yellow or orange, on jointed pedicels. Sepals 5, free, imbricate. Petals as many as sepals, or more. Stamens hypogynous, (10 or) indefinite; anthers linear, dehiscing longitudinally or by subterminal pores. Ovary deeply 3-10-lobed, 3-10-celled; cells uniovulate; style 1, central, slender. Fruit of 3-10 sessile drupes, inserted upon the enlarged torus. Seed exalbuminous.—Gen. Pl. i. 316; Royle Ill. 165; Wight Ill. i. 171.

1. OCHNA, Schreber.

Trees or shrubs, wholly glabrous. Leaves alternate, coriaceous; stipules axillary. Flowers yellow. Sepals 5. Petals 5-10. Stamens numerous, equal; anthers linear. Ovary 3-10-lobed.

A large shrub; flowers on short lateral racemes . .	1. *O. squarrosa.*
A small undershrub; flowers 3, on long axillary peduncles	2. *O. pumila.*

1. **O. squarrosa**, Roxb. Cor. Pl. t. 89 (1795); Fl. Ind. ii. 643; W. & A. Prodr. 152; Wight Ill. t. 69.—Syn. *O. lucida*, Lam. (1796).

A shrub or small tree; leaves elliptic-oblong, acute at both ends, 3-5 in. long, on short petioles, finely serrulate, with numerous fine, parallel, lateral nerves. Flowers in short lateral racemes on the previous year's wood, often on short generally leafless branchlets. Petals 7-12.

Bengal, Burma, South India. Will probably be found in the south-eastern part of the Centr. Prov. Fl. Feb., March. Fruit May, June. Grown in gardens.

2. **O. pumila**, Hamilton.—Syn. *O. humilis*, Hamilton; *O. collina*, Edgew. Trans. Linn. Soc. xx. 43. Vern. *Maidan-ka-kusum*, C.P.

An undershrub; leaves oblanceolate, 4-6 in. long, narrowed into a short petiole, serrulate with cuspidate teeth. Main lateral nerves distant, irregularly parallel. Flowers 3, on pedicels 1-2 in. long, peduncles axillary, nearly as long as leaf. Petals 5, longer than calyx.

Sub-Himalayan tract, principally in Sāl forests. Satpura range. South Konkan. Underground stem perennial, throwing up annually, after the jungle-fires, a number of subherbaceous stems to 2 ft. high, bearing leaves and flowers. Fl. April, May.

ORDER XX. BURSERACEÆ.

Trees or shrubs, often resinous. Leaves generally alternate, 3-foliolate, or imparipinnate, in some cases 1-foliolate, without stipules. Flowers small, bisexual or polygamous. Calyx 3-5-cleft. Petals 3-5. Stamens as many as petals, or twice their number, inserted on the edge or outside base of disc; anthers 2-celled, longitudinally dehiscent. Ovary free, 2-5-celled; ovules generally 2 in each cell, axile. Fruit generally drupaceous. Seeds one or few, pendulous, without albumen; cotyledons generally twisted or crumpled, radicle pointing upwards.—Gen. Pl. i. 321; Royle Ill. 174; Wight Ill. i. 180. (Suborder of Terebinthaceæ).

Leaves imparipinnate, with numerous leaflets.
  Fruit a 3-valved capsule, the valves separating from the axis; calyx small, open . . . 1. BOSWELLIA.
  Fruit a drupe; calyx campanulate . . . 2. GARUGA.
Leaves generally 3-foliolate . . . . . . 3. BALSAMODENDRON.

Bursera serrata, Wall. (*Icica indica*, W. & A. Prodr. 177), a large tree, with close-grained timber, esteemed for furniture—Assam, Chittagong, the Rajmahal hills—belongs to this family, and may possibly be found further west. Leaves large, imparipinnate; leaflets lanceolate, acuminate, glabrous. Flowers small, in axillary panicles; calyx small, indistinctly dentate; petals 5, inserted below disc; stamens 10; stigma sessile; drupe generally 1-seeded.

1. BOSWELLIA, Roxb.

Trees abounding in resin, with alternate imparipinnate leaves, crowded at the ends of branches. Flowers bisexual, hypogynous. Calyx small, open, 5-7-cleft. Petals 5-7. Stamens mostly 10, inserted at the base of the annular disc. Ovary half immersed in the disc, 3-celled; 2 collateral ovules in each cell. Fruit a 3-valved capsule, opening septifragally, the dissepiments remaining attached to the axis, and bearing 3 seeds, pendulous from the top of the inner angle, enclosed in a hard, bony shell, with a broad membranous wing, which is not the testa of the seed, but the endocarp of the fruit, separated from the outer layer of the pericarp. Seed without albumen; cotyledons trifid, lobes laciniate; radicle superior.

1. **B. thurifera,** Colebrooke; Roxb. Fl. Ind. ii. 383; W. & A. Prodr. 174.—Syn. *B. glabra*, Roxb. Pl. Cor. t. 207; Fl. Ind.; W. & A. Prodr. l. c.; Bedd. Fl. Sylv. 124. *Boswellia serrata*, Stackhouse (probably). Vern. *Salhe, Sale, Salai, Salei, Saler.* Local names: *Gūggar*, Kamaon; *Bhor-salai*, Gonds., C.P.

Young parts and leaves mostly pubescent, with simple hairs. Leaves crowded near ends of branches, 8-15 in. long; leaflets 8-15 pairs, opposite, or nearly opposite, sessile, lanceolate or ovate-lanceolate, from an oblique base more or less deeply crenate, apex generally rounded, obtuse. Flowers white, about ¼ inch across; a number of racemes, or racemose panicles, at the ends of branches, shorter than the leaves; bracts small, deciduous. Calyx cup-shaped, 5-7-toothed. Petals broad-ovate, shortly unguiculate. Anthers 10-12, hairy. Disc fleshy, red. Stigma 4-5-lobed. Bony endocarp heart-shaped, beaked, in the centre of an oblong, membranous wing.

Common throughout Behar, the Dekkan, to within 20 miles of the Western Ghats (Dalzell), the Central Provinces, Bandelkhand, and Rajputana, in the forest tracts at the foot of the Himalaya, westward as far as the Sutlej, also in South India. Grows chiefly on hot, arid hills, more or less gregariously, forming open forests, and often associated with *Sterculia urens*. Particularly abundant on the trap hills of the Dekkan and the Satpura range.

Deciduous, the old leaves fall about March and April, and are replaced in June by the fresh foliage. The flowers appear when the tree is leafless; sometimes before the old leaves fall, or after the young leaves have appeared. Rate of growth generally rapid; a tree in the Saharanpur gardens, 30 years old, measured 6 ft. girth. Throws up abundant coppice-shoots when felled, and grows readily from cuttings and stakes if planted during the rains.

A moderate-sized tree, generally not more than 30 ft. high, and 5-6 ft. girth, with a spreading, flat crown. Bark nearly ½ in. thick, juicy when fresh, inner substance brown. Outside usually greenish ash-coloured, peeling off in smooth thin flakes. Wood light-coloured when fresh, darker when seasoned, soft, spongy, coarse- and open-grained, 30-35 lb. per cub. ft., not durable. Used chiefly as fuel. Charcoal is made of it, used for iron-smelting in Nimar. From wounds and cracks in the bark exudes an abundance of transparent, fragrant gum-resin, diffusing, when burnt, an agreeable smell. It is used medicinally and as incense in India, and sold in the bazaars under the name of *Labanu*, *Kundur*, or *Kundura;* but it is not the Olibanon or frankincense chiefly used in Europe, which is yielded by several other species of *Boswellia* growing in the Somali country, and on the Hadramaut hills in Arabia, and described by Dr Birdwood in Trans. Linn. Soc. xxvii. 111.

I only know one sp. of *Boswellia* in Central India, well represented by Roxburgh's and Beddome's figures of *B. glabra*. There is, however, a difficulty in Roxburgh's description of *B. glabra* in the text of the Coromandel plants. He says, "It is one of the largest trees, with a hard, heavy, and durable wood. The lower masts of coast-built vessels are generally made of it, though its weight renders it less fit than fir or teak." These remarks would not apply to *Salai*, and Roxburgh's description may possibly refer to another species.

2. **GARUGA**, Roxb.

Trees with alternate imparipinnate leaves, crowded at the ends of branches. Flowers polygamous. Calyx campanulate, 5-cleft, valvate, inside lined by a thin disc with a crenate margin. Petals 5, inserted in the calyx-tube above the middle. Stamens 10, perigynous, inserted below the petals. Ovary ovoid, 4-5-celled; stigma capitate, 4-5-lobed; 2 collateral ovules in each cell. Fruit a globose fleshy drupe, with 5 or fewer bony nuts. Seeds solitary in each nut; cotyledons thin, twisted.

1. **G. pinnata**, Roxb.—**Tab. XIII.**—Pl. Corom. t. 208; Fl. Ind. ii. 400; W. & A. Prodr. 175; Bedd. Fl. Sylv. t. 118.—Vern. *Kharpat* (grass-leaf), *Katmanna*, *kitmirria*, *kilmira*, *karolu*, *katūla*, *sarota*, Pb.,

N.W.P.; *Ghogar, kaikar,* Oudh; *Kankar, kakar, kaikra, ghunja, ghurri, mahārut,* C.P.; *Chinyūk,* Burm.

Leaves approximate near the ends of branches, 6-12 in. long; leaflets 6-9 pairs, opposite or nearly so, nearly sessile, lanceolate or ovate-lanceolate, crenate, acuminate, glabrous or tomentose. Flowers yellow, in spreading panicles, several at the ends of branches; branches of inflorescence, pedicels, and calyx tomentose; bracts linear, deciduous. Calyx 10-ribbed. Filaments, ovary, and style hairy; stigma 5-lobed. Drupe fleshy, smooth, about the size of a nutmeg; nuts generally two, tuberculated outside.

Dry forests in the hilly regions of the greater part of Central and South India and Burma. At the foot of the Himalaya, and in the outer valleys (ascending to 3500 ft.) from the Jumna to Assam, often in Sāl forests; in North-West India frequently associated with *Odina Wodier,* which it resembles when leafless. Leafless during the greater part of the dry season. The fresh foliage generally appears in April or May, with the flowers or after them. The fruit ripens about June and July. Oval, smooth, brown galls on petioles not uncommon in November. Stakes of branches planted during the rains grow readily.

Under favourable circumstances a large tree, 50-60 ft. high, with an erect, straight trunk, 15-20 ft. long and 5-6 ft. in girth. Branchlets with conspicuous marks of lapsed petioles. Bark of trunk thick, light grey or brown, furrowed by shallow longitudinal wrinkles; outer layers getting black, and exfoliating in broad, irregularly angular flakes. Inner bark reddish brown. Sapwood large, whitish; heartwood dark reddish-brown, mottled, even- but rather open-grained, 52 lb. per cub. ft. (*Chinyūk* from Burma.) I am inclined to think that the wood of *Garuga pinnata* is often light-coloured and of less weight. Seasons well, durability doubtful, readily attacked by insects. Not much used for construction, but employed for indoor work, and as fuel. Has been recommended for cabinet-work. Bark employed for tanning; a gum exudes from it. The fruit is eaten, raw and pickled. Shoots and leaves are lopped as fodder, whence the name *Kharpat.*

3. BALSAMODENDRON, Kunth.

Small trees or shrubs, yielding aromatic resin; branches often thorny. Leaves alternate or crowded at the end of short branches, imparipinnate or 1-3-foliolate. Flowers polygamous. Calyx tubular, campanulate, or urceolate, 4-cleft, persistent. Petals 4, erect or with recurved tips, inserted at the bottom of calyx. Stamens 8, inserted on or outside the margin of a cup-shaped disc. Ovary sessile, 2-3-celled, narrowed into a short thick style; ovules geminate, collateral, pendulous. Fruit a drupe, the rind or epicarp frequently splitting more or less irregularly into 2-4 valves, leaving exposed the pulp or mesocarp, which encloses the nut. Nuts 1-3, with bony endocarp, either separate or more or less connate. Seed without albumen, one in each nut; testa membranous; embryo straight, the radicle pointing upwards; cotyledons thin, crumpled and plaited.

Most species of this genus inhabit Arabia and Eastern Africa, and several of these yield the Myrrh of commerce. Some of the Indian species also yield a fragrant gum-resin, which is an article of trade, under the name of *Gugal, gugul, guggur* (*mukul,* Arab.), which is believed to be the Bdellium of classic writers, and which most likely furnishes part of the Myrrh which is exported from Bombay. They are not important as forest-trees, in the sense in which this word is generally accepted, but they merit attention as forming part of the scanty arborescent vegetation of the arid hills of Sindh and Rajputana; and it is not impossible that a better knowledge of them, and increased attention paid to them, may eventually lead to increased production of a valuable article of commerce. Two species only are yet known from North-West India; a third, though indigenous in South India, is added to guard against misconception.

Leaves usually unifoliolate	1. *B. Mukul.*
Leaves ternate or imparipinnate.	
Unarmed	2. *B. pubescens.*
Thorny	3. *B. Berryi.*

1. **B. Mukul**, Hook.; Stocks in Hooker's Journal of Botany, i. (1849) t. 8; Boissier Fl. Orient. ii. 3.—Vern. *Gūgal*, Sindh.

Branches frequently spiniform; leaves generally approximate at the end of thick, short, tuberculate or woody branchlets, smooth and shining, obovate, almost sessile, the tapering base entire, the upper part shallow-toothed. On luxuriant shoots, the leaves are alternate, cuneate-obovate, rhomboid or oval, acute, deeply serrate, with a petiole, from the summit of which spring one or two lateral leaflets, smaller than the terminal leaflet, sometimes minute; young leaves, while in the bud, covered with glandular hairs, which soon drop off. Flowers small, subsessile, 2 or 3 together at the end of branchlets, unisexual. Males with ovary short and barren; females with short stamens and imperfect anthers. Calyx cylindrical, supported by 3 minute bracts, covered with glandular hairs; tube splitting as the ovary swells, remaining withered at the base of the fruit. Petals 4-5, strap-shaped, brownish red, tips curled back. Disc 8-10-toothed, bearing 8-10 filaments, alternately longer, the short filaments inserted in the sinus between the teeth, opposite to the petals. Stigma obscurely 2-lobed. Drupe red when ripe, ovate, acuminate, separating into 2 fleshy valves, leaving the nut enveloped by a 4-cleft yellow pulp (mesocarp), the lobes of which meet at the apex. Nuts ovoid, acute, readily splitting into two, each 1-celled. Drupes rarely 4-valved, 4 nuts, and 8-cleft pulp.

Abundant on rocky ground in Sindh, Kattiawar, at Deesa, in Beluchistan, and probably in Arabia. In Sindh it flowers in March and April; the leaves and young shoots appear in May. A small tree, 4-6 ft. high or more, generally a stunted bush, with thick-spreading branches. Trunk and branches knotty and crooked, with the ash-coloured bark coming off in rough flakes, leaving exposed the under bark, which is bright and shining, and peels off in rolls like thin paper. Wood light-coloured, even-grained, but soft and light, takes a fine polish. Dr Stocks gives the following account of the collection of the gum, which is known as Indian Bdellium:—

"In Sindh the Googul is collected in the cold season by making incisions with a knife in the tree, and letting the resin fall on the ground. It exudes in large tears, soft and opaque, hardens, and turns brownish black very slowly; a single tree is said to yield from half to a whole seer. It is brought to the bazaars of Hyderabad and Kurrachee, where it sells at the rate of 2 Rs. the maund of 80 lb. (1849)."

Nearly related to it, and probably the same species, is a shrub which I found on rocky hills in Rajputana in Dec. 1869 and Jan. 1870, with old leaves and unripe fruit, near Kishengurh, N.E. of Ajmir, and near Bednore, S.W. of that city, in both places under the name of *Gūgal*, yielding a fragrant gum-resin. The leaves are deep-dentate, and have peculiar, round, whitish vesiculose blotches, as if the epidermis had separated from the cellular tissue below. Specimens exactly corresponding with those collected by me in Rajputana are in the Kew Herb. from the Peninsula, apparently from the Bellary district. Madden, Journ. As. Soc. xvii. pt. i. 404, also mentions a *Balsamodendron* from Rajputana. In the Supplement to the 'Bombay Flora,' by Dalzell and Gibson, a similar shrub is described from Khandeish, under the name of *B. Roxburghii*, probably the same plant. It is said there, p. 20: "The whole plant is aromatic, abounding in a viscid balsamic juice, which is exported in considerable quantities from Oomrawuttee." This species will probably be found to be indigenous on arid, rocky hills throughout Rajputana and a great part of the Dekkan. However, in order to avoid the possibility of a mistake, the preceding description of *B. mukul* has been based exclusively upon Dr Stocks's paper, and the specimens collected in Sindh.

2. **B. pubescens**, Stocks l. c. t. 9; Boiss. Fl. Or. ii. 2.—Vern. *Bayi, bai*, Beluchistan.

A small tree or stunted shrub. Unarmed, pubescent; leaves trifoliolate, on slender petioles longer than leaflets, terminal leaflet stalked, generally fascicled on short tuberculate branchlets, but alternate on vigorous shoots, and then often imparipinnate; leaflets ovate or obovate, entire. Petals red or white. Stamens equal. Drupe red, valves 2, each cleft half-way up from below; mesocarp orange-coloured, 4-toothed, not reaching to the apex of the nut.

Beluchistan, and hills which separate that country from Sindh, as far south as Karāchi. The young shoots and buds are remarkably fragrant when bruised. In the cold season it yields a small quantity of tasteless, inodorous, brittle gum, almost entirely soluble in water. Fl. in March and April; leaves and young shoots appear in April and May.

3. **B. Berryi**, Arnott; Ann. of Nat. Hist. iii. 86 (1839).—Syn. *Protium Gileadense*, W. & A. Prodr. 177.

Most lateral branches terminating in thorns at right angles to main branch; leaves alternate or fascicled on short tubercular branchlets, trifoliolate, on slender petioles; leaflets sessile, obovate, the terminal one twice as large as the lateral ones, glabrous, generally entire. Flowers subsessile, fascicled; calyx 3-4-cleft; petals 3-4. Disc small, bearing 6-8 stamens alternately smaller, the larger ones opposite to petals; in the male flowers stamens longer than calyx. Drupe oblong, apiculate.

A small or middle-sized tree in the dry forests east of the Nilgiris, and cultivated as a hedge-plant all over South India. The whole tree has a grateful fragrance.

B. Gileadense, Kunth = *B. Opobalsamum*, Kunth,—Oliver Fl. Trop. Africa i. 326; Boiss. l. c. 2,—believed to be one of the Myrrh-yielding species, is a small unarmed tree, with 3-5 leaflets, in Nubia and Arabia.

ORDER XXI. MELIACEÆ.

Trees and shrubs, with alternate, generally pinnate, leaves, without stipules. Flowers regular, small, bisexual, a large proportion sterile, in large panicles, frequently with determinate inflorescence. Calyx small, 4-5-cleft. Petals generally 4-5, free, rarely connate. Stamens generally double the number of petals, rarely 5; the filaments in most genera united into a tube, rarely free, inserted on the disc, or outside at its base; anthers 2-celled, dehiscing longitudinally, introrse. Disc annular, cup-shaped or tubular. Ovary free, 3-5-celled; style 1; ovules either 2 in each cell or numerous; placentation axile. Fruit various; seeds with or without albumen.—Gen. Pl. i. 327; Royle Ill. 139; Wight Ill. i. 145, 148. (Cedrelaceæ.)

Stamens united in a tube; ovules 1-2 in each cell.
  Staminal tube cylindrical, 10-toothed, bearing 10 anthers at the top; petals erect . . . . 1. MELIA.
  Staminal tube globular or campanulate, bearing 5-10 anthers on the inside; petals concave, connivent at the top . 2. AMOORA.
  Staminal tube cleft into 8-10 divisions, each bearing an anther; petals erect . . . . 3. HEYNEA.
Stamens united in a tube; ovules numerous.
  Staminal tube urceolate, 10-toothed; seeds winged at the upper end, with a thin fleshy albumen . . . 4. SWIETENIA.
  Staminal tube cup-shaped, 10-cleft, each division 2-toothed; seeds winged at both ends; no albumen . . . 5. SOYMIDA.
Stamens free, inserted on the disc.
  Stamens 4-6, ovary 5-celled, capsule opening septifragally . 6. CEDRELA.
  Stamens 10; ovary 3-celled; capsule opening loculicidally . 7. CHLOROXYLON.

Besides the trees here described, this family contains the Chittagong wood, *Chickrassia tabularis*, Juss.; Bedd. Fl. Sylv. t. 9. A large tree of the hills of Eastern Bengal, Burma, and South India, with light-reddish wood, abruptly pinnate tomentose leaves, terminal panicles; staminal tube cylindrical, with 10 anthers on its edge; a woody 3-celled capsule, with numerous winged seeds.

1. **MELIA**, Linn.

Trees with alternate pinnate, bipinnate, or tripinnate leaves. Flowers white or purple, in large, branched panicles. Calyx 5-6-cleft, imbricate. Petals 5-6, linear-spathulate, convolute in bud. Stamens 10-12, monadelphous, edge of tube with 10-30 teeth; anthers inserted on the edge of the tube between the teeth, or within the tube below its mouth. Ovary 3-6-celled, surrounded at the base by the annular disc, continued into a cylindrical or filiform style, bearing a 3-6-lobed, deciduous stigma; ovules 2 in each cell. Fruit a fleshy or dry drupe, the putamen 1-5-celled, each cell containing 1 pendulous seed, with a crustaceous testa; albumen scanty or none; cotyledons foliaceous.

Leaves pinnate; flowers white; fruit 1-celled; endocarp cartilaginous . . . . 1. *M. indica.*
Leaves bipinnate; fruit 5-celled; endocarp osseous.
  Leaflets serrate, with large, often unequal, teeth; staminal tube glabrous, purple, edge with 20-30 teeth as long as anthers . . . . 2. *M. Azedarach.*
  Leaflets entire or crenate; staminal tube hairy, white, edge with an indefinite number of short subulate teeth, shorter than anthers . . . . 3. *M. composita.*

1. **M. indica.***—Syn. *M. Azadirachta,* Linn.; Roxb. Fl. Ind. ii. 394; Bedd. Fl. Sylv. t. 13. *Azadirachta indica,* Juss.; Wight Ic. t. 17; W. & A. Prodr. 118. The *Neem tree.* Sans. *Nimba;* Pers. *Azād-dirakht.* Vern. *Nīm.* Local names: *Betain,* Kamaon; *Limbo,* C.P.; *Nimuri,* Sindh.

Leaves imparipinnate, 9-15 in. long; leaflets 9-13, nearly opposite, shortly petiolate, 1-3 in. long, unequal-sided, ovate-lanceolate, sometimes falcate, deep and sharply serrate, acuminate, glabrous. Flowers white, with a strong smell of honey, especially at night, pentamerous, on short slender pedicels, with short scattered hairs, in large axillary panicles, shorter than leaf; bracts small, caducous. Calyx small, flat, with 5 rounded, obtuse segments. Petals spathulate, obliquely imbricate in bud. Anthers 10, linear, inserted opposite and below the teeth of the staminal tube. Ovary 3-celled. Drupe ovoid-oblong, size of an olive, smooth, dark purple when ripe; putamen cartilaginous, 1-celled, 1-seeded, reticulate outside.

A common tree throughout the greater part of India, as far west as the Sutlej; planted or self-sown, but (in N.W. India) nowhere really wild in the original forest. West of the Sutlej it is comparatively rare, and much smaller in size. Beyond the Jhelam it disappears altogether. Ascends to 5000 ft. in Kamaon. Never leafless; the fresh leaves issue in March and April before the old leaves fall. Flowers March-May; fruit ripens in July and August. Grows readily from seed; seedlings require shelter from frost in N.W. India; when cut, throws up abundant and vigorous coppice-shoots; growth fairly quick, 3-4 rings per in. radius.

A large tree, 40-50 ft. and higher, with a straight trunk, not long, attaining a girth of 6-9 ft., and a broad, rounded crown of dark-green foliage. Bark of trunk ½ in. thick, inner substance reddish brown or yellow, outside grey, with scattered small tubercles between numerous dark longitudinal and oblique wrinkled furrows.

Sapwood yellowish white; heartwood red or brown, especially the inner part, compact, closer than that of *M. Azedarach.* The weight of unseasoned wood is 55-60 lb. (Skinner), that of seasoned wood 45-52 lb. per cub. ft. Value of P. 539 (Puckle), 587 (Cunningham), and 720 (Skinner). Somewhat resembles mahogany, takes a beautiful polish; in South India much employed for furniture. Fairly durable, bitter, so that white ants or other insects will not touch it. Used for construction, cart-building, shipbuilding, and agricultural implements. Held sacred by Hindus, and used for making idols.

From incisions in the trunk near the base, made in spring, issues a quantity of sap, often flowing for weeks; used as a stomachic and cooling drink. A gum, used as a stimulant, exudes from the bark. From the fruit is extracted, by boiling or pressure, a fixed, acrid, bitter oil (*margosa*), deep yellow, with strong disagreeable flavour. It is used medicinally, in dyeing, as an antiseptic and anthelmintic, and is burnt in lamps. It is said to be expressed from the pulp, and not from the seed. It is exported from Madras, chiefly to Ceylon. The seeds are employed to kill insects, and for washing the hair. The leaves are bitter, and are used medicinally; the bark is very bitter, and is used as a substitute for Peruvian bark (Pharm. Ind. 53).

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* There is no sufficient ground for maintaining *Melia* and *Azadirachta* as distinct genera, and I follow the authors of the Gen. Plant. in reuniting them. Bnt the Linnæan names, *M. Azadirachta* for the *Nim,* and *M. Azedarach* for the *Bakain,* cannot remain side by side, as they are merely different modes of spelling the same word. This compels me to take Jussieu's specific name *indica.*

2. **M. Azedarach**, Linn.; Roxb. Fl. Ind. ii. 395; W. & A. Prodr. 117; Bedd. Fl. Sylv. t. 14. Boissier Fl. Orient, i. 954. *Persian Lilac, Bastard Cedar, Common bead-tree.*—Vern. *Drek, dek, jek, bakain, bukain, betain, deikna,* Pb., N.W.P. *Maha limbo, malla nīm, muhli,* C.P.

Young parts and inflorescence covered with minute stellate hairs. Leaves bipinnate, 9-18 in. long, pinnæ opposite or nearly so, with 3, 5, or 7 leaflets; leaflets ovate-lanceolate, shortly petiolulate, ½-1½ in. long, acuminate, more or less deeply serrate, sometimes lobed. Flowers generally pentamerous, lilac, with a strong honey-scent, on slender pedicels, in axillary panicles, shorter than leaf. Calyx deeply cleft; lobes oblong. Petals linear-spathulate, patent or reflexed. Staminal tube purple, ¼ in. long or more, with 20-30 linear teeth, as long as the anthers. Ovary 5-celled; stigma capitate, 5-sulcate. Drupe ovoid or globose, yellow when ripe, ½-¾ in. diam.; rind tough; putamen thick, hard, 5-celled, 5-seeded, or with fewer cells and seeds by abortion.

Commonly cultivated throughout India. In the Panjab it replaces the Nim, being rare in the east, and abundant in the centre and west of that province. Stocks found it wild in Beluchistan, and it is believed to be indigenous in the Lower Himalaya and the Siwalik tract. Generally it is found as a cultivated tree, ascending in the Himalaya to 5800 ft. It is commonly cultivated in Afghanistan, Western Asia, South Europe, the West Indies, South America, Australia, China, and the Indian Archipelago. Bare of leaves for 3-4 months in the cold season, in full leaf and bloom from March-May; very handsome at that time. The bunches of yellow fruit ripen in autumn, and remain on the tree while it is leafless, untouched by animals, except the Bulbul (Madden). In that state the tree presents a curious appearance. Grows readily from seed and cuttings; does not require much water. Young plants are not touched by rats. Throws up vigorous coppice-shoots when felled; the roots are shallow, spreading near the surface, and the tree is readily blown over. Rate of growth moderately rapid; the concentric rings correspond to the age of the tree. Specimens of 6¼ in., 4½ in., and 4¾ in. radius, showed respectively 22, 15, and 14 concentric rings.

A moderate-sized tree, 40 ft. high, and generally less, with a short, erect trunk, attaining a girth of 6-7 ft., generally hollow when larger, branches spreading into a large, broad crown. Bark of trunk ¼ in. thick, inner substance hard, brownish red, outside light and dark grey, with small oblong and white specks across, slight cracks, between long, deep, longitudinal, brown fissures, and shorter shallow ones across. The outer 3-4 rings are generally sapwood of yellowish colour; the heartwood is brownish, white, or often reddish, coarse-fibred, warps and splits, weighs only 30 lb. per cub. ft. (38-42 lb. unseasoned). Value of P. 596 (Skinner). The wood of old trees often handsomely marked, and used for furniture in the Peninsula. Bark extremely bitter; leaves and pulp of the fruit used in native medicine. From the fruit a fixed oil is extracted. The hard nuts are frequently strung as beads.

Melia sempervirens, Swartz., *the West Indian bead-tree*, Bot. Reg. t. 643; Grisebach, West Ind. Fl. 128,—is indigenous in Jamaica and Central America; but is almost certainly the same species as *M. Azedarach*. Roxb., l. c. 395, states that it is also a native of Persia, and that it is "a small delicate evergreen, of short duration compared with *M. Azedarach*, which is a robust deciduous timber-tree." Wight & Arnott (Prodr., 117) find no difference between the two species. In North America the root-bark of the tree enjoys considerable repute as an anthelmintic (Pharm. Ind. 55).

3. **M. composita,** Willd.; W. & A. Prodr. 117; Bedd. Fl. Sylv. t. 12. —Syn. *M. superba,* Roxb. Fl. Ind. ii. 396; *M. robusta,* Roxb. l. c. ii. 397. Vern. *Eisūr, limbarra, nīmbarra,* Bomb.

A large and handsome tree of rapid growth, with a smooth, dark brown bark, and large, bi- or tri-pinnate leaves; pinnæ 3-7-foliolate; leaflets entire or crenate. Flowers white, fragrant. Young leaves, inflorescence, calyx, and petals densely covered with a mealy stellate pubescence. Staminal tube less than ¼ in. long, villous with long white hairs; anthers inserted below the edge of the staminal column, which is divided into numerous small subulate teeth, shorter than the anthers. Drupes ovoid, of the size of a large olive, with a thick hard long putamen, 5-celled, or by abortion with fewer cells. The figure in Beddome's 'Flora Sylvatica' shows the anthers alternating with an equal number of teeth of the staminal tube. This I am unable to verify.

Western coast and Western Ghats. Burma, Malay peninsula. Indian Archipelago. Cultivated in gardens. Fl. Feb., April.; fr. Dec., Jan. Benth., Fl. Austr. i. 380, refers an Australian tree (Queensland, North Australia, New South Wales) to this species, and thinks that it scarcely differs from *M. Azedarach.*

2. AMOORA, Roxb.

Trees with imparipinnate leaves, and polygamous flowers, in spikes racemes or panicles. Calyx cup-shaped, or sepals distinct, 3-5. Petals 3-5, thick, concave, imbricate in bud. Staminal tube globose or campanulate; anthers 6-10, sessile on the inside of the tube. Disc 0. Ovary 3-5-celled, ovules 1 or 2 in each cell. Capsule 3-4-celled; cells 1-seeded. Seeds exalbuminous, with a fleshy arillus.

1. **A. Rohituka,** W. & A. Prodr. 119; Bedd. Fl. Sylv. t. 132.—Syn. *Andersonia Rohituka,* Roxb. Fl. Ind. ii. 213. Sans. *Rohitaka.* Vern. *Sohāga,* Oudh; *Harin harra,* or *Harin khana,* Hind.; *Tikta-raj,* Beng.

Leaves coriaceous, glabrous, varying to 2 ft. long; leaflets opposite, in 2-8 pairs, shortly petiolulate, ovate-lanceolate from unequal base, acuminate, entire. Flowers in spikes, small, white, nearly sessile, subtended by minute bracts; male spikes paniculate; bisexual spikes solitary or twin, supra-axillary. Calyx coriaceous, deeply cleft into 5 round obtuse lobes. Petals 3. Staminal tube globular, fleshy, white; anthers 6, attached half-way up the tube. Ovary 3-celled; stigma sessile, 3-lobed. Capsule pale yellow, soft and fleshy, obovoid, globose, or pyriform, 1 in. long, 3-celled, opening longitudinally by 3 valves from apex. Seeds solitary, with a chestnut-coloured, smooth, shining testa, surrounded by a scarlet arillus.

Oudh (only in moist ravines of the central and eastern part of the Gonda forests), Assam, Eastern Bengal, South India, along and near the Western Ghats. Ceylon. Evergreen; fl. in July, August; fruit ripens in the cold season. A moderate-sized tree, 30 ft. high, with a short, erect, straight trunk to 4 ft. in girth, with a close, shady, rounded head, somewhat resembling *Cedrela Toona* in general appearance. Bark thick, wood reddish brown, medullary rays very numerous, fine, pores large. In Bengal, oil is extracted from the seeds.

3. HEYNEA, Roxb.

Trees with imparipinnate leaves; leaflets opposite, petiolulate; common petiole articulate. Flowers bisexual, cymose, on axillary panicles; peduncles and pedicels articulate. Calyx small, 4-5-cleft. Petals 4-5, erect, imbricate. Staminal tube deeply 8-10-cleft, divisions linear, sharply 2-toothed at the top, and bearing an anther between the teeth. Ovary 2-3-celled, immersed in the fleshy disc; style short, clavate, with a fleshy ring at the top; ovules 2 in each cell, collateral. Capsule fleshy, 1-celled, 2-valved, 1-seeded. Seed without albumen, enclosed in an arillus, the radicle pointing upwards.

1. **H. trijuga**, Roxb. Cor. Pl. t. 260; Fl. Ind. ii. 390.—Vern. *Yakūshi*, Nepal. *Limbara*, Bomb.

Leaflets ovate-oblong, acuminate, glabrous, 2-4 pair, 4-8 in. long. Panicles corymbose, on long common peduncles. Bracts minute, caducous. Flowers numerous, small, white, pentamerous. Petals linear-oblong. Long hairs on both sides of staminal column; anthers 10, nearly sessile, between 2 subulate teeth nearly as long as anthers. Ovary 2-celled; style below stigma surrounded by a distinct fleshy ring. Capsule round, size of a small cherry, opening into 2 broad, oblong valves. Seed 1, round, invested in a complete, thin, white arillus; testa orange when fresh, chestnut-coloured afterwards; cotyledons hemispherical.

Oudh forests, Nepal, Bhutan, the Kasia hills, and west side of the peninsula. The old leaves are shed in March, and the fresh foliage appears soon afterwards. Fl. in Feb., March; fruit ripens Oct.-Feb. A moderate-sized tree, 30 ft. high, with an erect trunk, attaining a girth of 5 ft.; few spreading branches, forming a round crown. Bark of trunk dark ash-coloured. Bark and leaves are bitter, and contain an adstringent substance.

Closely allied to this species, and possibly not different from it, is *H. affinis*, Juss.; Bedd. Fl. Sylv. t. 134; from the western mountains of South India.

4. SWIETENIA, Linn.

1. **S. Mahagoni**, Linn.; Hook. Bot. Miscell. i. t. 16, 17. *Mahogany.*

A large tree, with abruptly pinnate, smooth, coriaceous leaves; leaflets opposite, on short petiolules, ovate, unequal-sided. Panicles axillary, pendulous, branches and pedicels slender. Flowers small, pale-greenish white, pentamerous. Petals patent, oblong. Staminal tube urceolate, 10-toothed; anthers alternating with the teeth. Disc annular, surrounding the base of the 5-celled ovary, with a short thick style and a flat discoid stigma. Capsule ovoid, 3-6 in. long, opening septicidally into 5 valves, leaving a large pentagonal axis in the centre. Seeds flat, attached to the top of the axis, with a long wing at the upper end; albumen thin, enclosing the flat foliaceous cotyledons.

A native of Central America and the West Indies; has been cultivated successfully near Calcutta and in Sikkim, and is grown as far north as Saharanpur. Fl. April. The excellent qualities of mahogany as a furniture-wood are well known; it is also used for shipbuilding. Heartwood large, reddish brown, very durable. The weight of Spanish, West India, and Honduras mahogany (seasoned), varies from 35 to 55 lb., and the value of P. from 425 to 637. The quality of the wood of trees grown at the Botanical Garden, Calcutta, and blown down by the cyclones of 1864 and 1867, was found excellent. In Bengal the tree has rapid growth, and bears seed, though sparingly. About 40,000 tons annually are imported into Great Britain from Honduras, Jamaica, and St Domingo.

5. SOYMIDA, A. Juss.

Trees, with bitter bark and paripinnate leaves. Flowers bisexual, pentamerous. Petals contorted in bud. Staminal tube cup-shaped, short, 10-cleft, each division with 2 short, fleshy teeth, the anther between them on a short filament. Ovary 5-celled, narrowed into a short style, with a broad fleshy stigma; ovules numerous in each cell. Capsule woody, 5-celled, 5-valved, opening septifragally, the valves separating from the dissepiments, which remain attached to the axis. Seeds numerous in each cell, imbricated, with long wings above and below; cotyledons foliaceous, auriculate at base, the radicle pointing upwards.

1. **S. febrifuga,** Juss.; Bedd. Fl. Sylv. t. 8; W. & A. Prodr. 122.—Syn. *Swietenia febrifuga,* Willd.; Roxb. Fl. Ind. ii. 398; Cor. Pl. t. 17. *Bastard cedar, Indian red wood.*—Vern. *Rohan, rohun, rohin, rohni, rohini, soymida.*

Glabrous; leaves abruptly pinnate, 9-12 in. long; common petiole with a thickened base; leaflets opposite, 3-6 pair, on short petiolules, oblong from oblique base, obtuse, 2-4 in. long. Panicles terminal, the main branches (in reality panicles from the axils of abortive, uppermost leaves) starting at acute angles from axis, the secondary branches at right angles; pedicels short; flowers greenish white. Bracts triangular. Calyx deeply 5-cleft; segments broad, obtuse. Petals obovate, narrowed into a claw. Capsule smooth, black when ripe, 1-2 in. long.

Common in the forests of Central India. Its northernmost known points are the forests of the Banswara State, in Rajputana, near the Mhye river, and the hills south of Mirzapur. As far as is known at present, the range of the tree does not extend beyond the 25th degree of N. lat. It is an important tree in the dry forests of the Central Provinces and many parts of the peninsula. Nearly evergreen. The young foliage issues in April and May, while part of the old leaves are still on the tree. Fl. in April and May; seed ripens, and is shed in July and August.

A large tree, 70-80 ft., with a tall, symmetrical, straight trunk, attaining a girth of 7-8 ft., with a large, rounded, dense head of numerous branches. Bark of trunk dusky, very rough, exfoliating in large plates or scales. Heartwood distinct, bright red when fresh-cut, dark reddish brown when dry, close-, straight-grained, and strong. Its weight, when seasoned, varies between 60 and 70 lb. per cub. ft., green 80-85 lb., P. 1024 (Skinner). Durable underground; not much attacked by white ants. Easily worked and planed, takes a fine polish, and being of a handsome grain and colour, seems well adapted for ornamental furniture. Held sacred by Hindus in parts of South India. Employed for construction, well-work; ploughshares are made of it, and pestles and pounders for oil-seeds. The bark is bitter, and has been used as a substitute for Cinchona bark. Mr Broughton reports that the bitter substance has the properties of a resin (Pharm. Ind. 55).

6. CEDRELA, Linn.

Trees with pinnate leaves, and small, paniculate, bisexual flowers. Calyx small, 5-cleft. Petals 5, erect, with a prominent thick line inside at the base like a keel, imbricate contorted or valvate at the base. Disc thick, fleshy, 5-cleft, or cylindrical. Filaments 4-6, inserted on the edge of the disc, subulate; anthers oblong, versatile, occasionally with alternate sterile filaments. Ovary 5-celled, narrowed into a style, with a broad stigma; ovules 8-12 in each cell, biseriate, pendulous. Capsule coriaceous or membranous, opening septifragally by 5 valves, the valves separating from the dissepiments, which remain attached to the axis, forming a pentagonal column of soft pith. Seeds numerous, pendulous, flat, imbricate, winged, with a scanty albumen, and straight embryo with foliaceous cotyledons, the radicle pointing upwards.

Flower-panicles as long as leaves, or shorter; leaflets generally entire; no sterile filaments; seeds winged at both ends 1. *C. Toona.*
Flower-panicles longer than leaves; leaflets serrate; sterile filaments alternating with stamens; seeds winged at the upper end only . . . . 2. *C. serrata.*

The West-Indian Cedar, *Cedrela odorata*, Linn., furnishes a beautiful wood for cabinet-work.

1. **C. Toona**, Roxb.—**Tab. XIV.**—Pl. Cor. t. 238; Fl. Ind. i. 635; W. & A. 124; Wight Ic. t. 161; Bedd. Fl. Sylv. t. 10. *The Toon-tree.* Sans. *Tunna, kuberaka, kachla.*—Vern. *Tūn, tūni, tūnni, līm, maha limbo, maha nīm.* Local names, *Māhlun′*, Satpuras; *Drawi, chiti-sirin*, Pb.

Leaves abruptly pinnate, 12-18 in. long, glabrous; leaflets generally opposite, 10-20, petiolulate, lanceolate or ovate-lanceolate, acuminate, entire or slightly undulate (toothed in South India). Panicles terminal, pubescent, nearly as long as leaves, pendulous, the lower ramifications frequently in the axils of leaves. Flowers white, with a fragrance like honey. Calyx flat, 5-cleft, lobes ciliate, obtuse. Petals oblong, ciliate. Stamens 5, inserted on 5 fleshy, orange-coloured, hairy lobes of the disc; sterile filaments none. Stigma peltate, 5-lobed. Capsule oblong, ¾-1 in. long, seeds with membranous wings at both ends.

Indigenous in the forests of South India, particularly on the west side, in Burma, Bengal, Oudh, and in the sub-Himalayan tract, nearly to the Indus, ascending to 3000 ft., and at times higher. Cultivated throughout India. Evergreen, or nearly so. The old leaves are shed gradually during the cold season, and the young foliage comes out in March and April with the flowers. The seed ripens June, July, the empty capsules remaining on the tree for months. Toon is a rapid grower. In 1863, I measured the following trees on the Eastern Jumna Canal above Saharanpur:—

Age 30 years, girth 58 inches, mean of 6 trees.
„ 35 „ „ 86 „ mean of 5 trees.

It requires, however, a rich soil and much moisture. In the Panjab plains

(Lahore and Amritsar) it requires shelter against frost while young, but grows freely afterwards.

Attains 60-70 ft. under favourable circumstances, with an erect, symmetrical but not tall trunk, 6-10 ft. girth (instances of 15-30 ft. girth are known). Branches numerous, forming a large, close, shady crown. Bark thin, ½ in. thick, dark grey, exfoliating when old with irregular, woody scales.

The sapwood is whitish, the heartwood red, or reddish brown, light, even- but open-grained, not strong, seasons readily, is easily worked, and polishes well, somewhat fragrant when sawn or broken. Annual rings distinct, pores large, close together in the inner wood of each ring, scarce in the outer wood. A cub. ft. of seasoned Toon weighs between 29 and 36 lb., and the value of P. fluctuates between 420 and 560. Baker's experiments with wood from Chittagong gives the weight between 34.6 and 45.9 lb., and the value of P. from 413 to 633; but this was probably not Toon, but *Chickrassia tabularis*, which is a somewhat heavier and stronger wood (weight 42 lb., P. = 614, Skinner). Highly valued as a furniture-wood, used for door-panels and carving. In Kangra was reckoned as a royal (padshahi) wood. In some parts of the hills the young shoots and leaves are lopped as cattle-fodder. The bark is a powerful adstringent (Pharm. Ind. 55), and from the flowers a red or yellowish dye is made.

Benth. (Fl. Aust. ii. 387) identifies the Red Cedar of New South Wales and Queensland (*C. australis*, F. Mueller) with *C. Toona*.

2. **C. serrata**, Royle Ill. t. 25.—Vern. *Drab, drawi, dor, dūnri, deri, khīshīng, dhal, dal, dala, dalli, daral, darlu*, N.W. Him.

Leaves usually imparipinnate, 15-20 in. long, glabrous; leaflets opposite, 15-25, on short petiolules, lanceolate or ovate-lanceolate, acuminate, serrate, teeth long and irregular, green above, glaucous beneath. Panicles terminal, large, longer than leaves, drooping; ramifications and pedicels covered with short rusty pubescence. Flowers occasionally hexamerous. Calyx cup-shaped; lobes ciliate or glabrous, obtuse. Petals oblong, not ciliate; disc glabrous. Sterile filaments alternating with stamens. Capsule ovoid, acute; seeds with a wing at the upper end only.

Valleys of the Himalaya, extending to the Indus, and ascending to 8000 ft., in moist, shady places. Often associated with *Sapindus*. Attains 70 ft., and 6 ft. girth, resembling *C. Toona* in appearance. The fresh foliage comes out in May, about the time that the old leaves are shed. The great clusters of flowers appear in May and June, and the seed ripens in August.

Sapwood whitish yellow, heartwood red, has on the Sutlej the smell of the pencil-cedar when fresh-cut, at times said to have a strong fetid smell. The wood is lighter-coloured, and more open in the grain, than that of the Toon, but much like it in appearance. The hoops of sieves are made of it; it is also used for bridges. Shoots and leaves are lopped for cattle-fodder.

7. CHLOROXYLON, DC.

A tree with abruptly pinnate leaves, and small paniculate, bisexual flowers. Calyx small, 5-cleft. Petals 5, spreading, clawed, imbricate. Disc thick, fleshy, 10-lobed. Stamens 10, inserted outside the base of the disc; anthers cordate, apiculate, versatile. Ovary immersed in the disc, 3-celled; style short; ovules 8 in each cell, axile. Capsule oblong, coriaceous, 3-celled, loculicidally 3-valved, the dissepiments remaining attached to the middle of the valves. Seeds attached to edge of dissepiments, imbricate, oblong, winged; no albumen; cotyledons plano-convex.

1. **C. Swietenia,** DC.; Bedd. Fl. Sylv. t. 11; W. & A. Prodr. 123.—Syn. *Swietenia chloroxylon*, Roxb. Cor. t. 64; Fl. Ind. ii. 400. *Satin-wood.* Vern. *Bhirra, bihra, girya,* C.P.; *Billu, hulda,* Bomb.

Young parts, petioles, and inflorescence covered with short grey pubescence. Leaflets 20-40, shortly petiolulate, unequal-sided, obliquely-oblong or semicordate, almost falcate, obtuse, about 1 in. long, glabrous, pale and dotted beneath. Panicles terminal and axillary; pedicels longer than flowers; bracts small, deciduous. Petals on short claws, obovate, obtuse, entire. Stamens nearly as long as petals, 5 generally shorter. Ovary covered with short white tomentum. Capsule 1 in. long, glabrous, dark brown when ripe. Seeds brown, angular, with broad wing at one end.

A common tree in the Satpura range, the Dekkan, the Konkan, and the drier parts of the peninsula and Ceylon. The fresh foliage appears in May, about the time that old leaves fall. Fl. March, April; the seed ripens in June, and remains on the tree for several months.

A small tree in Central India, in South India attaining 30-40 ft.; trunk straight, symmetrical. Bark yellow, soft, corky, ½ in. thick or more. Heart-wood, with a beautiful satin lustre, fragrant, when seasoned greenish white, with a yellow tinge, or yellow, mottled, and feathered, close-grained. Heavy, the cub. ft. weighs 51-66 lb. when seasoned, and 70-75 lb. when green. The value of P. has been found to fluctuate between 600 and 1059, and the average may be taken at 800. Has been compared to box, not found suited for engraving, but is excellent for turning. Employed for agricultural implements, cart-building, makes beautiful furniture, and picture-frames. Imported into England, used for cabinet-work and the backs of brushes.

ORDER XXII. OLACINEÆ.

Trees or shrubs, with alternate simple exstipulate leaves. Flowers 4-5-merous, uni- or bi-sexual, usually rather small. Calyx small, entire, or toothed, occasionally obsolete, unchanged or enlarged after flowering. Petals free or more or less connate, usually valvate. Stamens as many, or twice as many, as petals, free and hypogynous, or united below to the petals. Ovary free or partially immersed in the torus; 1-celled or incompletely 3-5-celled; ovules solitary or in pairs, pendulous. Fruit 1-celled, 1-seeded, indehiscent. Seed usually with copious albumen and a minute embryo.—Gen. Pl. i. 342; Royle Ill. 128; Wight Ill. i. 100.

Stamens and staminodes more numerous than petals; calyx enlarging . . . . 1. OLAX.
Stamens all antheriferous, as many as petals; calyx minute, unchanged . . . . 2. CANSJERA.

1. OLAX, Linn.

Shrubs or small trees, with alternate leaves, and small flowers. Calyx cup-shaped, enlarging after flowering (in the following species). Petals 5-6, free or slightly connected by alternating filaments. Stamens 8-12, of which only 3-5 are antheriferous, the anantherous ones opposite to the petals. Ovary free, 1-celled or with 3 imperfect cells, each with 1 ovule. Fruit drupaceous. Seed albuminous.

1. **O. scandens**, Roxb. Corom. Pl. t. 102; Fl. Ind. i. 163; W. & A. Prodr. 89.

A powerful climber, a few stout thorns on the older branches; branchlets, petioles, and midrib pubescent. Leaves distichous, alternate, ovate-oblong, shortly petiolate, 2-3 in. long. Flowers white, scentless, in short axillary racemes. Drupe globose, 1-seeded, $\frac{1}{3}$ in. diam., yellow, fleshy, more than half enclosed in the enlarged calyx.

South India, Ceylon, Burma, Behar, Satpura range, sub-Himalayan tract of Kamaon. On wet ground near rivers and ravines. Most destructive to trees, which it covers with its dense-spreading, dark-green foliage. Bark ash-grey. Fl. cold season.

O. nana, Wall., is a small undershrub with subsessile lanceolate leaves and solitary axillary flowers on slender peduncles. N.W. India, ascending to 5000 ft.

2. CANSJERA, Juss.

Climbing shrubs, with entire, alternate leaves, and small bisexual flowers in axillary spikes. Calyx minute. Corolla gamopetalous, 4-lobed. Stamens 4, opposite to the petals, and somewhate adnate to them; 4 hypogynous scales, alternate with the stamens. Ovary fleshy, 1-celled, with 1 ovule. Fruit a drupe, with a crustaceous endocarp. Seed ovoid; embryo minute in the axis of a fleshy albumen.

1. **C. Rheedii**, Gmelin.; Wight Ic. t. 1861.—Syn. *C. scandens*, Roxb. Cor. Pl. t. 103; Fl. Ind. i. 441.

A large evergreen climbing shrub, armed with a few stout scattered spines; young branches, inflorescence, and petioles minutely pubescent. Leaves ovate-lanceolate, 1½-3 in. long, short-petioled, glabrous, thick and somewhat fleshy, rugose when dry; main lateral nerves 3-5 pair, obliquely arching, the middle pair nearly meeting at the apex of leaf. Flowers sessile, yellow, in short axillary spikes. Corolla campanulate. Fruit orange-red, ovoid, about ½ in. long.

South India, western coast, Oudh forests (common in damp, well-wooded places). Fl. Sept.-March; fr. April.

ORDER XXIII. ILICINEÆ.

Trees or shrubs, generally evergreen, with alternate, simple, petiolate, glabrous leaves, exstipulate, or with minute, caducous stipules, and with small white flowers. Calyx imbricate in bud, 3-6-cleft, persistent. Petals 4-5, free or connate at the base, deciduous, imbricate in bud. Stamens as many as petals, alternating with them, hypogynous, free or adhering to petals, filaments subulate; anthers 2-celled, introrse, dehiscing longitudinally. Disc 0. Ovary free, 3-5- (rarely more) -celled, with a short style or sessile stigma. Ovules pendulous, 1 or 2 in each cell. Fruit a drupe, with 3 or more 1-seeded, free or connate stones. Seed with a membranous testa, fleshy albumen, and a minute straight embryo.—Gen. Pl. i. 355; Royle Ill. 166 (under Celastrineæ); Wight Ill. ii. 147.

1. **ILEX,** Linn.

Flowers generally bisexual. Calyx small, 4-5-parted. Corolla rotate, 4-, rarely 5-6-parted, divisions obtuse. Stamens adhering to base of corolla; anthers oblong. Ovary sessile, 4-6-celled. Drupe globose, with 4-8 stones, more or less distinct.

Leaves coriaceous, generally serrate, with strong spinescent teeth; flowers bisexual, tetramerous; drupe generally with 2 stones	1. *I. dipyrena.*
Leaves membranous, entire; flowers bisexual, pentamerous; drupe with 5 stones	2. *I. exsulca.*
Leaves coriaceous, crenulate; flowers unisexual, tetramerous; drupe with 4 stones	3. *I. odorata.*

To this genus belong the common English Holly, *Ilex Aquifolium*, L., a slow-growing shrub or small tree in the forests of western and southern Europe, from Norway to Turkey, on the Caucasus, and in Western Asia; stands deep shade, and produces a hard homogeneous wood. Also *Ilex paraguayensis*, the leaves of which yield the *Mati*, or Paraguay tea.

1. **I. dipyrena,** Wall.—**Tab. XV.**—Roxb. Fl. Ind., ed. Carey, i. 473; Wall. Pl. As. rar. t. 292. *Himalayan Holly.*—Vern. *Shangala*, *kandlu*, *kandlar*, *kalūcho*, *krucho*, *diusa*, *dodru*, *drūnda*, Pb.; *Kaula*, Nepal.

Extremities and pedicels pilose, leaves glabrous. Leaves coriaceous, shining, ovate or ovate-lanceolate, on short channelled petioles, some quite entire, but generally bordered with large, strong prickly teeth. Flowers tetramerous, bisexual, on short pedicels, with 2 small bracts, clustered in axillary rounded fascicles. Petals broadly ovate, obtuse. Stamens as long as petals. Ovary small, stigma sessile, obscurely 2-lobed. Drupe crowned with persistent base of style, red when ripe, dark brown when dry, globose, $\frac{1}{3}$ inch across. Stones 2, sometimes 3-4, irregularly furrowed and rugose outside.

Himalaya, from the Indus to Bhutan, between 5000 and 9500 ft. Not quite hardy in England. Fl. Apr.-June; fr. Aug.-Oct. A moderate-sized evergreen tree, 30-40 ft. high, with a straight symmetrical trunk, attaining a large girth. Madden records one of 16-17 ft. near Naini-Tal. Numerous branches, forming a dense oval crown. Bark of stem and larger branches greenish grey, smooth, slightly marked, with long shallow longitudinal, and short small transverse wrinkles. Foliage shining, dark green. Wood light-coloured, heavy, close and hard, with distinct medullary rays.

2. **I. exsulca,** Wall.—Syn. *Ehretia umbellulata*, Wall., and *Cassine excelsa*, Wall. in Roxb. Fl. Ind., ed. Carey, i. 344 and 376. Sometimes called *Ilex excelsa*. Vern. *Tūmari*, N.W.P.

Leaves membranous, ovate, acuminate, entire, glabrous, on petioles $\frac{1}{2}$ in. to 1 in. long, with minute, caducous stipules. Flowers bisexual, generally pentamerous, small, greenish white, fragrant, in axillary umbellate cymes, on a common pilose peduncle, varying in length, with small bracts at the base of pedicles. Petals spreading, then recurved. Stamens longer than petals. Stigma sessile, 4-5-lobed. Drupe globose, $\frac{1}{6}$ in. across, with five 3-sided stones.

Siwalik tract, and outer ranges of Himalaya, ascending to 6000 ft., from the Jumna to Assam, Kasia hills, and Malayan peninsula. Evergreen; blooms

March-August; fruit ripens October. In Kamaon a large-sized shrub. In Nepal, Wallich states that it grows to be a stately tree, with numerous spreading branches, forming a large crown. Bark of stem pale cinereous, dark grey, or brownish, with callous dots.

3. **I. odorata,** Hamilton; Don Prodr. Fl. Nepalensis, p. 189.

Glabrous; leaves coriaceous, on short sulcate petioles, oblong or oblong-lanceolate, acuminate, 4-8 in. long, crenulate; stipules minute, caducous. Flowers tetramerous, unisexual, crowded on short axillary cymose panicles, often 2 or 3 together; bracts small, at the base of pedicels. Stamens as long as, or longer than, petals. Stigma sessile, 4-lobed. Drupe ovoid, ¼ in. long, black, with 4 stones.

An evergreen tree in the outer ranges of the Himalaya, ascending to 6000 ft., from the Sutlej to Sikkim. Fl. in April; the fruit ripens in June.

ORDER XXIV. CELASTRINEÆ.

Trees or shrubs, with simple, alternate or opposite, generally coriaceous leaves; stipules none minute or early deciduous. Flowers small, inflorescence generally cymose. Calyx small, 4-5-cleft, imbricate. Petals 4-5, spreading, not clawed, inserted on the disc, imbricate. Stamens 3-5, inserted on the disc, alternate with the petals; filaments short, subulate; anthers short, 2-celled, dehiscing longitudinally. Disc large, surrounding the base of the 3-5-celled ovary. Ovules generally 2 in each cell; style short. Fruit various; embryo straight; radicle nearly always inferior.—Gen. Pl. i. 357; Royle Ill. 166; Wight Ill. i. 174.

Capsule 2-5-celled, dehiscing loculicidally; stamens 4-5; seeds albuminous.
  Capsule 3-5-valved; leaves opposite . . . . . . 1. EUONYMUS.
  Capsule 2-3-valved; leaves alternate . . . . . . 2. CELASTRUS.
Fruit indehiscent; leaves opposite; seeds albuminous . . 3. ELÆODENDRON.
Capsule 1-celled, 2-valved, laterally compressed; leaves opposite; stamens 3; seeds without albumen . . . . . . 4. HIPPOCRATEA.

1. EUONYMUS, Linn.

Trees or shrubs, with opposite leaves and deciduous stipules. Flowers bisexual, in axillary cymes. Calyx flat, 4-6-cleft. Petals 4-6, stamens as many, both inserted on a broad, fleshy, 4-6-lobed disc. Ovary immersed in disc, 3-5-celled; style short. Capsule 3-5-lobed and-celled, angled or winged, dehiscence loculicidal; cells 1-2-seeded. Seeds more or less enclosed in a fleshy arillus,[*] with a straight embryo enclosed in oily albumen.

Capsules smooth or rough, without prickles.
  Leaves membranous; cymes with small, numerous flowers.
    Capsules 4-lobed, not winged . . . . . . 1. *E. Hamiltonianus.*
    Capsules with 4 long tapering wings . . . . 2. *E. lacerus.*
  Leaves coriaceous; flowers more than ⅓ in. across.
    Capsules more or less winged; seeds enclosed in arillus 3. *E. pendulus.*
    Capsules not winged, arillus cup-shaped . . . 4. *E. tingens.*
Capsules covered with numerous subulate prickles . . 5. *E. echinatus.*

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[*] The arillus of *Euonymus* is sometimes called arillode, not being an enlargement of the funicle, but an excrescence of the outer coat of the ovule near the foramen.

Closely allied to *E. Hamiltonianus* is *E. europæus*, L., the *Spindle-tree*, a common European shrub, also found in North Africa and West Siberia, with 4-angled green twigs, greenish-white flowers, and 4-lobed crimson capsules. Wood used for turning, and to make charcoal for the finer sorts of gunpowder.

1. **E. Hamiltonianus**, Wall.—**Tab. XVI**.—Wall. in Roxb. Fl. Ind., ed. Carey, ii. 403.—Syn. *E. atropurpureus*, Roxb. Fl. Ind. i. 627. Vern. *Sīngi*, *sīki*, *chual*, *watal*, *papar*, *rīthu*, *ranāi*, *brahmāni*, *banchor*, *karūn*, *skīoch*, *sidhera*, Pb.; *Agniūn*, *agnu*, Kamaon.

Branches and branchlets round, glabrous, green. Leaves 2-5 in. long, glabrous, membranous, oblong-lanceolate, finely serrulate, acuminate, on petioles about ⅓ or ½ in. long. Cymes regularly dichotomous, axillary and intra-axillary, opposite, occasionally clustered on undeveloped branchlets, with 15-30 greenish-white flowers; bracts minute, deciduous. Petals oblong, obtuse. Stamens shorter than, or as long as, petals. Capsule yellow, deeply 4-lobed, not winged; seeds entirely enveloped by a scarlet arillus.

Common in the Outer Himalayan ranges from the Indus to Bhutan, between 3800 and 8500 ft. Kasia hills. Generally in mixed forests, where there is some shade. Fl. from March - June; the fruit ripens from Aug. onwards. Hardy in England. A large shrub, under favourable circumstances a moderate-sized tree, 30-35 ft. high, with a short straight trunk, 4-5 ft. girth; bark of stem smooth, yellowish cinereous, or reddish brown. Wood beautifully white, compact and close, not very hard, used for making spoons. Young shoots and leaves lopped for fodder.

2. **E. lacerus**, Ham.—Syn. *E. fimbriatus*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 408. Vern. *Sīki*, *battali*, *pattali*, *banchīr*, *dudhapār*, *pāpar*, *hunchu*, *pāsh*, *mara*, *chīkan*, *rang chūl*, *kioch*, Pb.

Young shoots of the current year compressed alternately in either direction; branches round, glabrous, grey or reddish-brown. Leaves 2-4 in. long, glabrous, membranous, elliptic or broadly ovate, shortly acuminate, serrate, serratures frequently serrulate, decurrent into petioles about ½ in. long; stipules minute, linear, deciduous. Cymes umbelliform, on long slender peduncles; main branches 3-7, slender, each bearing a simple or compound umbellate fascicle of small flowers. Bracts linear, deciduous. Cymes inserted near the base of this year's branchlets, most below the first leaf, a few in the axils of the lower leaves. Flowers small, tetramerous. Petals white. Anthers on short filaments. Capsule with 2-5, generally 4, vertical, long tapering wings, the valves when ripe spreading out flat when opening. Seeds ovoid, enclosed in a bright red arillus.

In many parts of the Himalaya, but not common. At higher elevations than the preceding species, generally between 6000 and 11,000 ft. from near the Indus to Sikkim. Open places in forests. Fl. from March-June; fruit ripens from July-Oct. A small, handsome tree, 25 ft. high, with a short straight trunk to 3 ft. girth; bark of stem grey, or brownish grey, smooth, and with slight longitudinal wrinkles. Foliage dark green, red in autumn before falling. The wood is white, close-grained, and tough; it is carved into spoons. Young shoots and leaves are lopped to feed goats. In Bussahir the seeds with their bright red arils are strung up and used as ornaments.

3. **E. pendulus**, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 406. Sometimes called *E. japonicus.*—Vern. *Chopra*, *pincho*, *garūr*, *kūnku*, N.W.P.

Young twigs angular or compressed; leaves 2-4 in. long, oblong-lanceolate, coriaceous, glabrous, pale, often cinereous beneath, sharply serrate; petioles sulcate, less than ½ in. long; stipules minute, with a few long hairs. Cymes axillary, opposite, with 3-20 flowers, on peduncles 2 in. long, often flat, sulcate, regularly dichotomous, or bearing 3 or more branches. Bracts ovate, lacerate. Flowers tetramerous, rarely pentamerous, ⅓ in. across. Calyx-lobes obtuse, fimbriate. Petals whitish, oblong, fimbriate. Stamens nearly as long as petals; anthers ovate, short. Style short, filiform. Capsule 3- or 4-lobed, the angles sharp, more or less winged; seeds enclosed in a thin arillus.

Locally (nowhere common) in the Himalaya between 2500 and 7500 ft., rarely ascending to 8500 ft., from the Jhelam to Nepal and further east. Fl. in April and May; the fruit ripens in June and July. A small, elegant tree, to 40 ft. high, with a short straight trunk, 2½ ft. girth; numerous branches ascending and spreading; the ultimate branchlets drooping, forming an oval crown. Bark of trunk dark grey, brownish, or yellow, scabrous and longitudinally rugose. Young foliage brown and shining; old, dull grey.

4. **E. tingens**, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 406.—Vern. *Kungku*, N.W.P.; *Newar*, *Kasūri*, Nepal.

Branchlets indistinctly 4-sided; scales of buds lanceolate, fimbriate. Leaves 1-2 in. long, glabrous, coriaceous, ovate or ovate-lanceolate, obtusely serrate or crenate, acute or shortly acuminate, on short petioles, with brown subulate, fimbriate stipules. Cymes axillary, approximate, in pairs at the base of this year's branchlets; peduncles varying in length, the longest 2 in., with regular dichotomous cymes of 3-7 large flowers ½ in. across, pentamerous or tetramerous, with linear-lanceolate, fimbriate bracts. Divisions of calyx broadly ovate, irregularly dentate or fimbriate. Petals orbicular, shortly unguiculate, white or yellowish, beautifully marked with dark purple veins. Stamens a little shorter than petals; anther-cells diverging, attached to a horseshoe-shaped connective. Style subulate, as long as stamens. Capsule 3- 4- or 5-cornered, not winged; seeds oblong, with a cup-shaped arillus.

Himalaya, from 6500-10,000 ft., from the Sutlej to Nepal. Fl. from April-June, the fruit ripening in August and Sept. A small tree, to 20 ft. high, with a short, erect, symmetrical trunk, 2½-3 ft. girth; few branches, forming a small, rounded crown. Bark dark cinereous, or yellowish brown, with numerous yellow tubercles, and whitish longitudinal cracks and wrinkles, inner substance brown, with fine white fibres. Wood light brown, fine-grained, compact and hard, not porous, with fine indistinct medullary rays. Wallich states that the Nepalese employ the bark for the purpose of marking the forehead.

E. grandiflorus, Wall. Pl. As. rar. t. 254, may possibly be synonymous with this species; but the figure represents the capsule as ovoid, and does not show the dark veins of petals, and the figure is supported by the description of *E. grandiflorus* in Fl. Ind., ed. Carey, 404.

5. **E. echinatus**, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 410.

Branchlets tetragonal, with 4 thick lines, decurrent from either side of the petioles; scales of buds brown, fimbriate, often persistent at the base of the current year's shoots. Leaves 2-3 in. long, decurrent into short petioles, coriaceous, oblong-lanceolate, crenate or obtusely serrate, with minute stipules. Cymes axillary, shorter than leaves, with 3-10 tetramerous, peagreen, scentless flowers; bracts small, triangular, fimbriate. Capsules globose, ⅓ in. across, beset with numerous subulate prickles, 4-valved, with 4 ovoid seeds, entirely enveloped in a thin, scarlet arillus.

In many parts of the Himalaya range, between 7000 and 12,000 ft., from the Jhelam to Sikkim. Fl. in March and April; fruit ripens about August, and often remains several months hanging on the branches. Most frequently a large shrub, stem and branches often climbing and trailing like ivy to a considerable distance over trees and damp shaded rocks, attaching itself by dense tufts of capillary rootlets to 2 in. long. Occasionally a small handsome tree, 15-20 ft. high, with a short straight trunk, 12-16 in. girth. Branches opposite, smooth, ash-coloured, bark of stem light grey, with parallel longitudinal furrows; inner substance soft, spongy, yellow.

2. CELASTRUS, Linn.

Leaves alternate; stipules minute, deciduous. Flowers small, frequently unisexual. Calyx 5-cleft. Disc flat or cup-shaped. Petals 5, usually spreading. Stamens 5, inserted upon or under the margin of the disc; anthers 2-celled, dehiscing longitudinally. Ovary 2- 3- rarely 4-celled; style short; stigma generally lobed. Capsule globose or oblong, 3-2- or 1-celled, with 1 or 2 seeds to each cell, dehiscing loculicidally. Seeds often arillate, with a fleshy albumen; cotyledons foliaceous; radicle inferior.

Armed with axillary spines; cymes lateral; capsule generally 3-celled, 3-valved.	
Peduncles capillary, 1-1½ in. long; leaves lanceolate . .	1. *C. rufus*.
Cymes subsessile; leaves ovate or obovate	2. *C. spinosus*.
Armed with axillary spines; cymes axillary, with divaricate branches; capsule generally 2-valved, 1- or 2-celled . .	3. *C. senegalensis*.
Unarmed, climbing; cymes in a terminal compound raceme .	4. *C. paniculatus*.

1. **C. rufus**, Wall. in Roxb. Fl. Ind., ed Carey, ii. 397.

A tree, sparingly armed with axillary short spines; wholly glabrous. Leaves subcoriaceous, lanceolate, serrulate, 3-5 in. long. Peduncles numerous, lateral, fascicled, capillary, reddish, 1-1½ in. long, bearing a dichotomous cyme of a few small white flowers, supported on capillary pedicels. Bracts lanceolate. Capsule obovate, 3-valved, 3-celled, 3-seeded.

Himalaya from Kamaon to Bhutan, ascending to 6000 ft. Kasia hills. Fl. March, April; fruit ripe June.

2. **C. spinosus**, Royle; Boissier Fl. Orient. ii. 11.—Syn. *Gymnosporia spinosa*. Vern. *Dzaral*, trans-Indus; *Kandu*, *kandiāri*, *pātāki*, *lei*, *phūpāri*, *badlo*, *kadewar*, Pb.; *Kūra*, *bāgriwāla dārim*, *gwāla dārim* (*darim* is Pomegranate), N.W.P.

Glabrous, armed with numerous straight axillary spines, generally about ¾ in. long. Leaves on short petioles, broadly ovate or obovate, crenate, coriaceous, cinereous. Cymes axillary, subsessile or shortly pedunculate, often fascicled on short dichotomous branchlets; flowers numerous, up to 30; bracts small, triangular, ciliate. Calyx-lobes obtuse, ciliate. Petals oblong, reddish, with white margins. Filaments subulate, inserted under edge of disc; anthers oval, versatile. Disc 5-lobed, fleshy, surrounding base of 3-celled ovary. Style short cylindrical; stigma 3- or 5-lobed. Capsule turbinate or obovoid, 3-celled, 3-cornered, ⅓ in. long; seeds half covered with an aril.

Common in Afghanistan and North-West India, extending as far as Kamaon in the Outer Himalaya and Siwalik tract; also reported from Bandelkhand. Generally on dry, hot, rocky, rugged slopes, often on *kankar* soil. In flower and fruit from March-Nov. A stiff, densely-branching shrub, 8-12 ft. high, usually with strong, stiff, sharp spines, rarely unarmed. Bark dark grey, or with a reddish tinge, scurfy, but not much marked; foliage dull greyish green. The seeds have a bitter taste.

3. **C. senegalensis**, Lam.; Boissier Fl. Orient. ii. 11; Bedd. Fl. Sylv. anal. t. x. 2.—Syn. *C. montana*, Roxb. Fl. Ind. i. 620; W. & A. Prodr. 159; Wight Ic. t. 382. Vern. *Sherawane*, trans-Indus; *Talkar*, *dajkar*, *mareila*, *kingaro*, *kharāi*, Pb.; *Baikal*, *gajachinni*, C.P.; *Māl kangoni*, Bomb.

Glabrous, glaucous or pale green, usually armed with numerous straight axillary spines, generally 1-2 in. long, and often bearing leaves and flowers. Leaves variable in form and size, coriaceous, entire or crenate, narrowed into petiole, obovate oblanceolate or linear-spathulate. Cymes axillary, often 2 or more together on short tubercular branchlets, regularly dichotomous; branches divaricate; bracts triangular, fimbriate. Flowers small, pale greenish white, a large proportion sterile. Lobes of calyx obtuse or acute, fimbriate. Petals oblong, with entire or fimbriate edges. Disc broad, flat, 10-lobed. Filaments subulate; anthers round, versatile. Style short; stigma 3-lobed. Capsule globose or ovoid, about the size of a small pea, generally 2-valved, often 1-celled, with 1, 2, rarely 3 seeds; occasionally 3-valved. (The seeds of this species should be examined; some of the specimens before me have an arillus, others are naked.)

This plant has a wide distribution, from the Mediterranean region over a great part of tropical Africa to India. It is common in many parts of the Panjab trans-Indus, in Sindh, the Salt range, about Delhi, in the Siwalik tract, and the outer Himalaya (ascending to 4000 ft.), in Guzerat, the Dekkan, and many parts of the Peninsula. The specimens from Sindh, Afghanistan, and Delhi have narrow, those from South India have broadly obovate leaves. Mostly in stony, rocky, dry, barren localities. Fl. at various times throughout the year, the seed ripening in summer and autumn.

A tall shrub, under favourable circumstances a small tree 15-20 ft. high, with a short crooked trunk, 2-4 ft. in girth, stiff branches forming a loose oval crown. Bark of stem ¼ in. thick, yellowish, reddish, or purplish grey. Wood white, close-grained, hard, and durable; the leaves are thrashed out and used as fodder, the branches employed as dunnage for the roofs of houses.

4. **C. paniculatus**, Willd.; Roxb. Fl. Ind. i. 621; Wight Ill. t. 72; Ic. Pl. t. 158; W. & A. Prodr. 158.—Syn. *C. nutans*, Roxb. l. c. 623. Vern. *Māl kākni*, Oudh, N.W.P.; *Kākundan, rangul, wāhrangur*, C.P.; *Kanguni*, Bomb.

Unarmed; climbing or scrambling. Leaves glabrous, broadly-ovate or obovate, acuminate, crenate. Flowers unisexual; cymes arranged in terminal, compound, elongated panicles; peduncles and pedicels pubescent; bracts fimbriate. Calyx-lobes rounded, toothed; disc mostly connate with the cup of the calyx. Stamens inserted on its free margin; anthers attached near the base. Capsule globose, generally 3-valved, 3-celled, 3-6-seeded. Seeds enclosed in a complete red arillus.

A large scrambling or climbing shrub, probably diœcious, common in many parts of India. Outer Himalaya, ascending to 4000 ft., from the Jhelam to Assam, Eastern Bengal, Behar, and South India. Leaves and seeds are used in native medicine; an oil is extracted from the seeds, which is used medicinally.

3. **ELÆODENDRON,** Jacq. fil.

Shrubs or trees with alternate or opposite leaves, and small caducous stipules; flowers small, occasionally unisexual, in axillary cymes. Calyx 4-5-cleft. Petals 4-5-spreading. Disc thick, fleshy, angled. Stamens 4-5, inserted under the edge of the disc; anthers nearly globose. Base of ovary confluent with disc, 3-celled, rarely 2- or 5-celled; style short; ovules erect, 2 in each cell. Fruit a dry or fleshy indehiscent drupe, the putamen 1-3-celled, 1, rarely 2, seeds in each cell. Seeds erect, without an arillus; albumen scanty or copious, enclosing a straight embryo, with flat cotyledons.

1. **E. Roxburghii**, W. & A. Prodr. 157; Wight Ill. t. 71; Bedd. Fl. Sylv. t. 148.—Syn. *Neerija dichotoma*, Roxb. Fl. Ind. i. 646. Vern. *Mirandu, padriūn, bakra, jamoa*, Pb.; *Bakra, shauria, chauli, daberi, māmri*, N.W.P.; *Chauri, metkūr*, Oudh; *Jamrassi, jumrassi, kala muka, rohi*, C.P.; *Dhakka marrah*, Gondi; *Tamruj*, Bomb.

Leaves glabrous, generally opposite, on petioles ½ in. to 1 in. long, elliptic ovate or oblong, acuminate, crenate, coriaceous; stipules small, triangular, deciduous. Cymes axillary, dichotomous, spreading, as long as or shorter than leaves; peduncle longer than petiole; branches divaricate; bracts small, caducous. Calyx-segments broad, round, obtuse. Petals oblong with membranous edges, yellowish brown and white. Stamens shorter than petals; filaments recurved; anther-cells attached to a broad semicircular connective, diverging at base. Drupe ovoid or obovoid, ½ in. long, yellowish green when ripe, thin, fleshy; putamen 1-celled, 1-seeded, crustaceous.

Common in the Siwalik tract and outer Himalaya, ascending to 6000 ft., from the Ravi to Sikkim. Behar, Bandelkhand, Oudh forests, the Central Provinces, and the Peninsula. The old leaves shed in February and March, the young foliage issues in May; the full-grown foliage is dark green and shining. Fl. Feb.-June, the fruit ripening in April and May of the following year.

A moderate-sized tree, at times a shrub only, attains 30-50 ft. in the Oudh forests, with an erect, symmetrical trunk, attaining from 3-8 ft. in girth, numerous branches forming a close oval crown. Bark of trunk thin, cinereous, or ferruginous, smooth, with irregular longitudinal wrinkles, or dark and scurfy. The wood is whitish or light reddish-brown, even, close, compact; a cub. ft. weighs 40-50 lb. when seasoned, and 60-65 lb. when green. Value of P. 511 (Fowke), 513 (Skinner). Seasons well, works easily, and is durable. Is often beautifully curled and flaked, and takes a fine polish; is used for cabinet-work, and recommended for picture-frames. The root is believed to be a specific against snake-bites, and the bark is used in native medicine, said to be a virulent poison. The young tree is often attacked by an aphis, and in consequence a saccharine matter is excreted on the leaves.

4. **HIPPOCRATEA,** Linn.

Climbing shrubs or trees, with opposite, entire or serrate, coriaceous leaves. Flowers bisexual. Sepals 5. Petals 5, longer than sepals. Stamens 3. Ovary 3-celled. Fruit-carpels 3, distinct, each 1-celled, laterally compressed, 2-valved, the valves navicular. Seeds 1-3, compressed, erect, attached to the base of the capsule, the funicle dilated into a broad wing. Albumen none; cotyledons flat, oval; radicle short, inferior.

Leaves 5-6 in. long; capsule 3 in. long . . . . 1. *H. arborea.*
Leaves 2-3 in. long; capsule 1-1½ in. long . . . 2. *H. indica.*

1. **H. arborea,** Roxb. Cor. Pl. t. 205; Fl. Ind. i. 167.

A large climber, with long flexuose branches, wholly glabrous. Leaves ovate, or ovate-oblong, shortly acuminate, serrulate, 5-6 in. long; petiole ½ in. long; main lateral nerves 6-8 pair, arcuate. Flowers yellow, in axillary, pedunculate cymes. Capsules 1-3, at the end of terminal peduncles, obovate-oblong, acute at both ends, 3 in. long and 1½ in. broad, thickly coriaceous, with numerous prominent longitudinal nerves. Seeds 2. Wing of seed tawny, ovate, 1½ in. long, smooth, corky. Seed ¾ in. long. Cotyledons greenish yellow, fleshy.

Abundant in the mixed forests of Baraich and Gonda in Oudh (R. Thompson). Ascends the largest forest-trees, often enveloping them with its thick, heavy foliage. Leaves renewed April, May. Fl. in July, and the fruit ripens in April.

2. **H. indica,** Willd.; Roxb. Cor. Pl. t. 130; Fl. Ind. i. 165; W. & A. Prodr. 104.—Vern. *Kazurati*, Bomb.

A climbing shrub, wholly glabrous. Leaves ovate, acuminate, crenate, 2-3 in. long; petiole ½ in. long. Flowers rusty yellow, in axillary, pedunculate cymes. Capsules oblong, striated, 1-1½ in. long, ⅓ in. broad. Seeds 2, reddish brown; wings membranous.

South India, Bengal, Behar, and probably Central India, Burma, Ceylon, Indian Archipelago; also in tropical Africa. Fl. Jan-April.

ORDER XXV. **RHAMNEÆ.**

Trees or shrubs, often armed with spinescent branches or stipular spines. Leaves simple, alternate or opposite. Flowers small, often unisexual, green or yellow. Inflorescence generally cymose. Calyx 4-5-cleft; lobes triangular, valvate in bud. Petals generally present, inserted on the calyx-tube near the edge, and alternate with its segments. Stamens opposite the petals, and often enclosed by them, inserted with the petals or on the edge of the disc; anthers 2-celled, bursting longitudinally. Disc annular cupular or coating the calyx-tube. Ovary free, or more or less adhering to the calyx-tube, 2- or 3-celled, rarely 4-celled, with one erect ovule in each cell. Fruit various, with 1-3 seeds, with or without albumen, and a large embryo.—Gen. Pl. i. 371; Royle Ill. 168; Wight Ill. i. 179.

Fruit a fleshy, rarely dry drupe or berry, 1-3-seeded.
  Armed with stipular spines; leaves 3-5-nerved . . . 1. ZIZYPHUS.
  Unarmed; stipules foliaceous; leaves with numerous prominent parallel lateral nerves . . . . 2. BERCHEMIA.
  Armed with spinescent branches, or unarmed; calyx-lobes deciduous . . . . 3. RHAMNUS.
  Unarmed; branches of cymes swell into a fleshy mass . . 4. HOVENIA.
  Armed with spinescent branches, or unarmed; calyx-lobes persistent . . . . 5. SAGERETIA.
Fruit a dry 1-seeded nut, terminating in a long narrow wing . 6. VENTILAGO.

1. **ZIZYPHUS,** Juss.

Shrubs or trees, generally armed with stipular spines. Leaves alternate, more or less distichous, petiolate, with 3-5 main nerves from the base. Flowers small, mostly bisexual, generally in axillary cymes. Calyx-tube cup-shaped, or broad-obconical; limb 5-cleft, the divisions keeled inside. Petals sometimes wanting, generally 5; lamina more or less concave or hood-shaped. Disc coating the calyx-tube, edge free, pentagonous or 5-10-lobed. Ovary immersed in disc, more or less confluent with it, 2-celled, rarely 3- or 4-celled; styles 2-3, free or partly connate. Drupe fleshy, kernel generally woody or osseous, 1-3-celled, 1 seed in each cell. Seeds with a smooth, brittle testa; albumen thin, enclosing the embryo; cotyledons thick, flat, or convex; radicle short.

Drupe fleshy; kernel 1-2-celled.
  Cymes axillary, nearly sessile; petals 5.
    Glabrous; young parts only pubescent.
      Branchlets often fasciculate; drupe large; kernel 2-celled, with thick, hard, osseous shell. . . . . . 1. *Z. vulgaris.*
      Branchlets single; drupe small; kernel 2-celled, with thin crustaceous shell . . . . 2. *Z. oxyphylla.*
    More or less tomentose.
      A straggling or climbing shrub; drupes small, ¼ in. long 3. *Z. Œnoplia.*
      A tree; drupes globose oblong or ovoid, ½-¾ in. long, or longer . . . . 4. *Z. Jujuba.*
      A low thorny shrub; drupes globose, ½-⅓ in. diam. . . 5. *Z. nummularia.*

Cymes axillary and terminal, long-pedunculate, forming a large thyrsus; petals none; kernel 1-celled, 1-seeded, shell thinly crustaceous . . . . 6. *Z. rugosa.*
Drupe nearly dry; kernel 3-celled, shell thick, hard, osseous; cymes axillary, short-pedunculate . . . . . . 7. *Z. xylopyra.*

1. **Z. vulgaris**, Lam.; Roxb. Fl. Ind. i. 609; Boiss. Fl. Orient. ii. 12. —Syn. *Z. flexuosa*, Wall. French, *Jujubier.* Vern. *Sīnjli, Sīmli, bān, barj, phitni, relnu, ber, kāndika, kandiāri, birāri*, Pb.

A small tree, glabrous; branches brown and shining, frequently covered with a dull grey cuticle, flexuose or zigzag, with 2 strong stipular thorns, and one or more branchlets at each bend. Thorns grey or brown, shining, unequal, one straight, up to 1 in. long, or longer, the other much shorter, uncinate (straight while young). Branchlets often fasciculate, slender, nearly straight, with 10-30 alternate, bifarious leaves on short petioles, having frequently the appearance of imparipinnate leaves. Leaves obliquely ovate-lanceolate, obtuse, bluntly serrate, with 3 main basal nerves and finely reticulated veins between, without any prominent secondary nerves. Flowers yellowish, 2-12 on short pedicels, with small fimbriate subulate bracts, fasciculate on short axillary cymes; styles 2, rarely 3, distinct from base. Drupes solitary, pendulous, on short slender pedicels, ovoid or oblong, obtuse at both ends, ½ in. to ¾ in. long, dark red or black, glabrous, shining, fleshy; kernel 2-celled, rugose; shell thick, hard, osseous. *Z. nitida*, from China, Roxb. l. c. 609, is stated to have a pale yellow fruit when ripe, but is otherwise very similar to *Z. vulgaris.*

Wild and cultivated in the N.W. Himalaya from the Ravi to the Indus, ascending to 6500 ft. Also cultivated in the Panjab plains, in Beluchistan, and Bengal. Beyond India it is found, indigenous or cultivated, in Japan and China, in Western Asia, Greece, Macedonia, and North Africa. Cultivated and runs wild in the south of France, Corsica, and Italy. Not quite hardy in the south of England. Fl. from March-June, and the fruit ripens from September through the cold season. Leafless in winter.

In the Panjab often a shrub, in clusters or dense clumps, under favourable conditions a small tree, 25-30 ft., with a short, somewhat crooked trunk, to 5 or 6 ft. girth, few rigid spreading boughs, and stiff branches, often unarmed, the prickles having fallen off. Bark of stem dark grey, rough with longitudinal furrows. The full-grown foliage is of a beautiful bright glossy green. The leaves getting yellow before falling, impart a peculiar hue to tracts where the tree is common—*e. g.*, near the great lake of Kashmir. The leaves are subject to the attacks of a small insect. About one-third of the radius of the stem is white sapwood, the heartwood being dark brown. In France the wood is used for cabinet-work, under the name of *Acayou d'Afrique*, sp. grav. 1.09.—Matthieu Fl. Forestière, 50. The fruit (in India) is acid, but well flavoured; that of the Mediterranean tree is sweet. Formerly officinal under the name of *baccæ jujubæ.* The tree was known to classical writers; in Plinius and Columella it is called Zizyphus. Though it reproduces itself spontaneously in Greece and the south of France, it is not originally indigenous in those countries, but was introduced from Syria during the reign of Cæsar Augustus.

2. **Z. oxyphylla**, Edgew. in Trans. Linn. Soc. xx. 43.—Vern. *Kūrkan ber*, Afg.; *Pitni, kokan ber, amlāi, amnia, beri, shamor*, Pb.; *Giggar*, N.W.P.

A small tree, glabrous, with a few scattered hairs on young parts; 2-year-old branches purple, or covered with a dull grey epidermis; branches and branchlets slightly flexuose, smooth, armed with pairs of slender purple stipular spines, one shorter, straight or curved, the other straight to ½ in. long. Leaves on petioles ⅛ in. long, ovate-lanceolate, base oblique, long-acuminate, mucronate with a hard brown point, finely serrate, the serratures mucronate with brown points, main basal nerves 3, the middle nerve with 2 or 4 prominent lateral nerves, joined by reticulate veins. Flowers 3-20, on slender pedicels ¼ in. long, fasciculate on short thick peduncles; bracts small, brown, subulate; calyx-lobes carinate to middle; petals clawed, expanding into a hood-shaped lamina; disc thin, membranous, pentagonous; styles 2, united to near the apex. Drupe ovoid, ⅓ in. long, 2-celled, 2-seeded, pendulous, red or black when ripe, putamen flattened, shell thin crustaceous, seeds with a brown shining testa.

Found occasionally on the eastern flanks of the Suliman range trans-Indus, and in the outer Himalaya as far as the Ganges, at elevations from 2000 to 6000 ft. A small tree, 25-30 ft. high, and 5-6 ft. girth, resembling *Z. vulgaris* in general habit. Fruit eaten, but very acid.

3. **Z. Œnoplia,** Mill; W. & A. Prodr. 163; probably *Z. Napeca*, Roxb. l. c. 613.—Vern. *Shya-kūl*, Beng; *Tōzīben*, Burm.

A straggling or climbing shrub; branchlets strigose, or oftener covered with dense ferruginous tomentum, slightly flexuose, armed with short, straight or hooked and recurved stipular prickles, which are brown, shining, tomentose at base, and generally solitary. Leaves distichous, on short petioles, strigose or rusty tomentose beneath, with long adpressed simple hairs, ovate or rhomboid, base oblique, shortly acuminate, entire or minutely denticulate, generally with 4 main basal nerves, 2 in the larger, and 1 in the smaller half of the leaf, all with numerous prominent parallel lateral nerves. Cymes short, axillary, dichotomous, with 20-30 flowers; peduncles, pedicels, bracts, and calyx densely tomentose. Divisions of calyx keeled to the middle; petals generally shorter than calyx. Drupes 1-3 together, on slender pedicels, generally longer than peduncles, globose or obovate, black, ¼ in. long, 1- or 2-celled; shell woody or osseous.

Kamaon, Rohilkhand, Lower Bengal, Behar, Assam, Silhet, Chittagong, Burma, the Peninsula, Java, Ceylon, and Mauritius. Abundant in the Baraich forests of Oudh. Leaves renewed March, April. Fl. in the hot, ripens its fruit in the rainy season and autumn. The fruit is eaten. A common hedge-plant in South India.

The two last species require further attention. There appear to be intermediate forms, and there are forms of *Jujuba*, which, as far as herbarium specimens go, only differ from *Œnoplia* by the size of the fruit.

4. **Z. Jujuba,** Lam.—**Tab. XVII.**—W. & A. Prodr. 162; Roxb. Fl. Ind. i. 608; Wight Ic. t. 99; Bedd. Fl. Sylv. t. 149; Boiss. l. c. 13.—Sans. *Badara, karkandhu, koli*. Vern. *Bēr, bēra, bēri*. (*Zīben*, Burm.)

A moderate-sized tree, ends of branches decurved or drooping, in some varieties erect or spreading, tomentose, rarely glabrous. Two-year-old branches slightly flexuose, either dull brown, or covered with grey epidermis. Branches and branchlets armed with short stipular spines, generally twin, one straight, the other bent, or both equal, or one wanting, or entirely unarmed. Leaves sessile, short-petiolate, or on petioles ¼ the length of leaf, oblong-ovate, or nearly orbicular, obtuse or acute, 1-3 in. long, entire or serrulate, often mucronate, occasionally with a few large irregular teeth near the apex, with 3 main basal nerves, and more or less prominent lateral nerves. Leaves generally bright tawny- or nearly white-tomentose beneath, dark green and glabrous above, or more or less glabrous on both sides. Flowers greenish yellow, somewhat fetid, on short axillary subsessile, or short-pedunculate cymes; pedicels longer than peduncles. Calyx-lobes keeled to the middle; petals unguiculate, with an oblong concave or hood-shaped lamina; anther-cells parallel; disc fleshy, 10-lobed, 10-sulcate; styles 2, thick, conical, connate to middle. Drupe varying in size, generally about ½ or ¾ in. long, on a stalk about half its length, globose, oblong, or ovoid, dark brown, orange or red when ripe; kernel irregularly furrowed, mostly 2-celled, with a hard, thick, bony shell.

This sp. varies exceedingly, in the shape and size of the fruit, the shape and tomentum of the leaves, and general habit. A remarkable variety, commonly cultivated in the Panjab, from Peshawar to Multan, has been described by Edgeworth (Journ. Linn. Society, vi. 201) as *Z. Jujuba*, var. *Hysudrica*. It is characterised by obtuse, oblong or ovate, sometimes orbicular leaves, on long petioles ¼ length of leaf, glabrous or slightly tomentose beneath, the branchlets not drooping, but erect or spreading. Dr Stewart refers this variety to *Z. Lotus*, Lam., but is of opinion that the Zizyphi of North India want more investigation on the spot. *Z. Lotus*, however, is a shrub nearly allied to *Z. nummularia*. *Z. Spina Christi*, Willd.—Boissier Fl. Orient. ii. 13—which Edgeworth states in the same place, is found in gardens in the Panjab, is a large tree of Western Asia, northern and tropical Africa, with white branches, ovate, almost glabrous leaves, petioles ¼-⅓ length of blade; cymes large, compact, sessile, with numerous flowers, and a ring of white hairs (not in all specimens) round the base of the style; fruit-stalks often nearly 1 in. long. I do not venture to refer any of the specimens which I have examined from the Panjab either to *Z. Lotus* or to *Z. Spina Christi*, and I think it preferable at present to class all *Bēr* trees of North and Central India under *Z. Jujuba*. There is no difference in the inflorescence and structure of the flower; and as regards shape and tomentum of the leaves, there are intermediate forms.

Z. Jujuba is wild in some places of the Siwalik forests east of the Ganges (J. L. Stewart), and in South India (Beddome). Cultivated and self-sown, it is common in Afghanistan, Sindh, the Panjab, ascending in the outer Himalaya to 3000, and at times to 4500 ft., and throughout the rest of India and Burma. Further researches are required to define the localities where the tree is actually wild, forming part of the original forest. It is common in forests of Central and South India; but wherever I have seen it, it has been on sites of deserted villages or temporary settlements. The young foliage appears in March, April, while the old leaves are shedding; there is often a second flush in July and August. Fl. usually April-June, also at other seasons; the fruit generally ripens from December-March.

A moderate-sized tree, 30-50 ft. high, stem short, erect, not very straight, girth 6-8, occasionally 10 ft., branches numerous, spreading in all directions, forming a broad, rounded crown, giving dense shade. Bark ½-1 in. thick, dark grey, almost black, cut up into obliquely oblong plates by deep irregular longitudinal furrows and short shallow cross-cracks. Inner substance reddish brown, showing in cracks and furrows. Wood light-coloured when fresh-cut, turns reddish brown on exposure to the air. Sapwood ¼ of the radius, of lighter colour. According to Skinner, a cub. ft. of seasoned wood weighs 58 lb., and the coefficient of transverse strength (P) is 672. Cunningham gives the following figures for sap and heartwood: sap—Weight 51.08, P. 330-385; heart—Weight 57.41, P. 477-513. The wood is hard, close-, and even-grained, fibrous, tough and durable, a favourite material for saddle-trees (for horses' and camels' saddles), also used for building, agricultural implements, Persian wheels, oil-seed-crushers, well-curbs, legs of bedsteads, sandals, tent-pegs, and other purposes. Yields good charcoal, and is valuable as fuel.

Lakh is produced on this tree in Sindh, the Panjab, and Central India. The bark is used as dye-stuff; the root is a febrifuge in native pharmacy. A gum exudes from the trunk; and in Kangra a wild silkworm lives on the tree, the silk of which was much employed formerly to tie the barrel to the stock of the matchlock. But the tree is mainly cultivated for its fruit, which is more or less globose on the wild and commoner sorts, and ovoid or oblong on the cultivated and improved kinds. The pulp is mealy, sweetish, with a pleasant taste, and some of the cultivated kinds are very good indeed. The dried fruit of this species, and possibly also of *Z. vulgaris*, is sold in the bazaars of the Panjab under the name of *unāb*; the best kind is imported from Kandahar. In South India oil is extracted from the kernel. The leaves are much valued as cattle-fodder. The tree is readily raised from seed: young plants do not suffer much from frost, except that they lose their leaves; they stand a good deal of drought, but their roots are often eaten by rats. It thrives best on sandy loam, and on ploughed land; but it can be grown also on soils too saline for *Toon*, *Mulberry*, and *Sissoo*. Its growth is less rapid than of *Sissoo* or *Kikar*, but it coppices with great vigour, and will on that account probably prove a most valuable tree in the Panjab plantations.

5. **Z. nummularia**, W. & A. Prodr. 162; Boissier Fl. Orient. ii. 13.—Syn. *Z. microphylla*, Roxb. Fl. Ind. i. 613. Sometimes called *Camelthorn*, but erroneously (see *Alhagi Maurorum*). Vern. *Karkanna*, Afg.; *Malla*, *ber*, *berra*, *birār*, *jhāri*, *jharberi*, *jand*, *kānta*, N.W. India; *Gangr*, *jangra*, Sindh.

A thorny, bushy shrub, tomentose; branches brown, or covered with white epidermis; branchlets bifarious, flexuose, armed with twin stipular prickles, pilose while young, one straight, slender, very sharp, ¼-½ in. long, the other much shorter, hooked, bent downwards. Leaves on short petioles, ovate, obtuse, denticulate; main nerves 3, with few prominent lateral nerves. Flowers 10-20, in axillary, short, compact cymes; pedicels ¼ in. long, longer than peduncles. Calyx-lobes keeled nearly to the base; petals spathulate, expanding into a broad-obovate, concave or flat lamina; disc slightly 10-lobed, 10-furrowed; styles 2, nearly distinct. Drupe globose, ⅓ in. diam., red, glabrous, shining when ripe; kernel rugose, 2-celled, with a hard osseous shell.

Common throughout North-West India and the drier parts of South India above the Ghats; not known from Bengal and Burma. Gregarious, covers extensive tracts in the Panjab, Sindh, Rajputana, and the Dekkan. Ascends to 3000 ft. on the eastern flanks of the Suliman range and in the outer Himalaya. Flourishes best in a heavy clay or loam; is abundant in the black soil of the Dekkan. South-West Persia.

Z. nummularia is always a bush, usually 6-8 ft. high, rarely attaining 15 ft., forming irregular rounded masses of thorns, with numerous clustered stems, and suckers thrown up from the roots. The bark of stems and main branches is grey, rugose; the foliage has a dull greyish-green colour. It is never leafless—the old leaves generally shed early in the hot weather, and the new leaves appear immediately afterwards. Fl. March-June, and the fruit ripens from November-January. The principal use of this species is to make fences round fields and gardens; the leaves are thrashed out and used as fodder for sheep and goats; the fruit is eaten, is sweet and acidulous, and has a pleasant flavour. During the famine of 1869, which drove large numbers of the inhabitants of Marwar and other parts of western Rajputana from their homes, the fruit of this bush served as food to thousands. In the winter '69-'70, the crop of these berries had been plentiful; and when I marched through Rajputana, from Agra to Guzerat, in Dec. 1869 and Jan. 1870, I found the shrubs completely stripped of their fruit wherever the flocks of hungry emigrants from Marwar had passed through; and it was only further south, on approaching Neemuch and Guzerat, where the Marwar emigrants had been less numerous, that I found the shrubs laden with fruit.

Of the Zizyphi outside India, *Z. Lotus*, Lam.; Boiss. l. c. 12; a small shrub from Northern Africa, comes nearest to this. Like *nummularia, Z. Lotus* has an eatable fruit, which is an important article of food in Tunis and Barbary. It throws up abundant suckers from the root, and the description given in Mathieu's Flore Forestière de la France, p. 50—"Parfois l'abord de cet arbrisseau (in Algeria) est rendu presque impossible par l'entourage serré des drageons épineux qu'il a produits"—would apply well to *Z. nummularia*. But the African shrub is almost quite glabrous, and the two styles are united nearly to the top. There is much variation in the species of Zizyphus as to pubescence, and the degree to which the styles are united; but, on the other hand, there does not yet seem sufficient ground for uniting *Z. nummularia* and *Z. Lotus*. It should be added that there are forms of *Z. nummularia* which are exceedingly similar to frutescent specimens of *Z. Jujuba.*

6. **Z. rugosa,** Lam.; W. & A. Prodr. 162; Wight Ic. t. 339.—Syn. *Z. latifolia*, Roxb. Fl. Ind. i. 607. Vern. *Dhaura, dhauri*, Baraich and Gonda in Oudh; *Suran, Churna*, C.P.; *Tūran*, Bomb.

A straggling shrub or small tree; young branches, inflorescence, prickles, and under side of leaves generally covered with a dense ferruginous tomentum, rarely glabrous. Branches armed with broad, laterally compressed, strong, hooked prickles, mostly solitary. Leaves on petioles ¼ in. long, with 3 or 4, rarely 5, nerves from base, and prominent lateral nerves, ovate or elliptic from an oblique, often cordate base; 2-5 in. long. Cymes large, on long peduncles, axillary and terminal, forming a large compound, generally drooping thyrsus. Lobes of calyx outside tomentose, inside with a prominent pilose line, but not keeled; petals none; anthers broad-ovate; disc pentagonous. Drupe globose or pyriform, $\frac{1}{4}$-$\frac{1}{3}$ in. long, with a 1-celled, 1-seeded kernel, and a thin crustaceous shell.

Burma, hills of Eastern Bengal, Behar and Sikkim, sub-Himalayan tract as far as the Ganges, Oudh forests, Central Provinces, western side of the Peninsula, and Ceylon. A straggling evergreen shrub, often climbing, occasionally a small tree with a trunk 2 or 3 ft. in girth. Fl. Nov.-March; the fruit ripens in April and May. Bark exfoliating with flat quadrangular scales of dark brown or blackish colour. The fruit is eaten, has a peculiar mawkish flavour; the wood is used as fuel, often attacked by insects.

7. **Z. xylopyra**, Willd.; Roxb. Fl. Ind. i. 611; W. & A. Prodr. 162.—Syn. *elliptica* and *Caracutta*, Roxb. l. c. 610, 612. Vern. *Katbĕr*, *khatbŏr*, *bĕri*, *gūti*, *ghotia*, *goti*, *gotti*, *ghūter*, *gotāha*, *kakoa*, *kakor*, *ghatūl*, *chettu*, *chittānia*, *ghwĕt*, *sitaber*.

A large straggling shrub or small tree; young branchlets, under side of leaves, and inflorescence generally short- and softly tomentose. Stipular prickles generally twin, one straight, the other hooked, recurved, strong, and very sharp. Leaves on short petioles, oval or rhomboid, finely serrulate, from an unequal-sided, often cordate base, with 3 or 4 main basal nerves, and prominent lateral nerves, pale, softly tomentose beneath. Cymes axillary, compact, on short peduncles, with numerous (occasionally tetramerous) flowers; pedicels shorter than main branches of cyme. Lobes of calyx keeled near apex; petals on long claws, hood-shaped. Ovary 3-celled; styles 3, short, distinct. Drupe usually globose, occasionally oblong, with the remains of calyx marked as a prominent ring at base; $\frac{1}{2}$-1 in. long, covered with a short, soft, grey tomentum, glabrous when old; dry, almost without fleshy pericarp; putamen furrowed, 3-celled, 3-seeded, with a thick, hard, osseous or ligneous shell.

Common all over South India, in Rajputana, the Central Provinces, Bandelkhand, and Behar; also in the Oudh forests, and the sub-Himalayan tract as far as the Ganges, ascending to 2000 ft. The old leaves are shed about Feb. or March; the new foliage issues in April and May; the flowers appear about the same time; and the fruit ripens from Sept.-Feb.

A large straggling shrub, and under favourable conditions a small tree to 15 ft. high. Often gregarious, covering considerable tracts with an impenetrable thorny scrub. Bark of trunk and larger branches light or dark cinereous or brownish black, surface smooth or cracked with thick, oblong, exfoliating scales. Heart- and sap-wood not distinct, clean, whitish red when fresh-cut, when dry yellowish white, orange or brownish, hard and tough, 60 lb. per cub. ft., P = 800 (Skinner). Easily worked and durable, used for cart-building and other purposes. Bark employed for tanning; the young shoots, leaves, and the fruit serve as fodder for cattle and goats. The fruit is not eatable for man, but it is largely collected and sold to be used (after being charred) in making a black dye for leather. The kernels are eaten. The wood makes excellent torches.

2. BERCHEMIA, Neck.

Shrubs or woody climbers, unarmed, with foliaceous, often intra-axillary stipules. Leaves alternate, penniveined, elegantly marked underneath with parallel nerves diverging from the midrib, and small transverse veinlets. Flowers pentamerous. Calyx-segments linear or triangular, deciduous. Style simple; stigma capitate, more or less 2- or 4-lobed. Fruit a small, ovoid or oblong, 2-celled berry or drupe, on the persistent, but not enlarged, base of the calyx.

Flowers in small, axillary or terminal clusters . .	1. *B. lineata.*
Flowers in large, terminal panicles	2. *B. floribunda.*

1. **B. lineata**, DC.; Benth. Fl. Hong Kong, 67.

Leaves small, to ½ in. long. Flowers 2-4 together, either in the axils of the leaves, or a few clusters together at the ends of branches above the leaves. Calyx-lobes long-triangular; petals as long as calyx, linear, sheathing and surrounding the stamens. Berry blue, cylindrical, ¼ in. long.

A small shrub, with grey bark, in Waziristan trans-Indus at 7000 ft., and from the Indus south-eastward at 4000-5000 ft., in Sikkim at 8000-10,000 ft. Common in China. Fl. from May-July, the berries ripening in Sept.

1. **B. floribunda**, Brongn.—Syn. *Zizyphus floribunda*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 368. Vern. *Kala lag*, Kamaon.

A large shrub or small tree, erect or climbing, with leaves 2-3 in. long, stipules intra-axillary bifid; flowers 3-10, in cymose clusters, arranged in racemes 2-3 in. long, which again form large, terminal panicles. Berries cylindrical, ⅓-½ in. long.

N.W. Himalaya from the Jhelam to Sikkim, Kasia hills. Fl. June-July. Near to, if not identical with, *B. racemosa*, Sieb., from China and Japan.

3. RHAMNUS, Linn.

Shrubs and trees, with alternate, petiolate leaves, penniveined, or with 3 nerves proceeding from base, and small deciduous stipules. Flowers often unisexual. Calyx 4-5-cleft, the segments triangular or ovate, deciduous, keeled inside, or with a prominent line. Petals 4-5, or none. Stamens 4-5, with short filaments. Disc clothing the calyx-tube; petals and stamens inserted on its edge. Ovary free, 3-4-celled, narrowed into a 3-4-cleft style; stigmata papillose, obtuse. Fruit an oblong or globose drupe on the persistent, but not enlarged, base of the calyx, with 2-4 1-seeded kernels. Seeds with a fleshy albumen; cotyledons flat or with recurved margins, often green; radicle short.

Unarmed; leaves and branches alternate.	
Pubescent; flowers in axillary sessile cymes . .	1. *R. purpureus.*
Tomentose; sessile cymes forming interrupted racemes	2. *R. triquetrus.*
Generally spinescent.	
Leaves and branches generally opposite . . .	3. *R. virgatus.*
Leaves and branches always alternate . . .	4. *R. persicus.*

1. **R. purpureus**, Edgeworth.—**Tab. XVIII.**—Trans. Linn. Soc. xx.

44.—Vern. *Bat sinjal*, *tūnāni zanāni* (*tūnāni madāni* (male) is *Viburnum fœtens*), *tadru*, *tūndhi*, *mimarāri*, *kunji*, *chaterni*, Pb.

Unarmed, the previous year's branchlets purple, young parts pubescent, Leaves and branchlets always alternate. Leaves membranous, ovate or ovate-lanceolate, acuminate, 3-4 in. long, serrate, with 6-10 prominent, parallel, nearly straight lateral nerves on either side of midrib, on petioles ¼ in. long; stipules linear, early deciduous, and leaving broad scars at the base of petiole. Flowers 1-5, mostly pentamerous and bisexual, in axillary sessile cymes; flower-buds ovoid. Calyx flat, cup-shaped; segments triangular; petals none. Style short, 3-cleft nearly to the base. Drupe pear-shaped, ¼ in. long; seeds 2-4.

A moderate-sized tree on the outer Himalaya ranges, from the Indus to the Sarda river, between 4500 and 10,000 ft., usually in the more open parts of the forests. Fl. in May and June. The fruit ripens from July-October. The small bitter fruit is used as a purgative in some parts of the hills.

2. **R. triquetrus**, Wall.—Syn. *Ceanothus triquetra*, Wall.; Fl. Ind., ed. Carey, ii. 376; *C. flavescens*, Royle. Vern. *Gūlde*(*i*) or *gūdle*(*i*), *fagora*, *gardhan*, *phulla*, Pb.; *Gogsa*, *ghant*, *ghont*, N.W.P.

Unarmed; leaves and branchlets covered with short tomentum, always alternate. Leaves generally yellow, ovate-oblong, acuminate, 3-5 in. long, serrate, on petioles ¾ in. long, with 6-10 prominent parallel, nearly straight lateral nerves on either side of midrib; stipules subulate, deciduous. Flowers generally pentamerous, in sessile, 5-20-flowered cymes, forming interrupted racemes, frequently leaf-bearing and branched. Flower-buds ovoid. Calyx turbinate, segments triangular. Petals short-clawed, emarginate, sheathing the stamens. Style 3-4-cleft, the branches cohering nearly to the apex. Durpe 3-lobed, nearly dry. Seeds on the back (the side of the raphe), with a long, broad, open groove.

Not uncommon in the Salt range and in the North-West Himalaya, between 3000 and 6000 ft., from the Jhelam to the Sarda river. A small tree, with grey, brown, or blackish purple bark, scabrous with elevated specks. Fl. in May and June.

3. **R. virgatus**, Roxb. Fl. Ind. i. 604.—Syn. *R. hirsutus*, W. & A. Prodr. 165; Wight Ic. t. 978. Vern. *Phipni*, *dādūr*, *tadru*, *seta pajja*, *kānji*, *mamrāl*, *shomfol*, *reteon*, *gogsa*, *sindrol*, *mūtni*, *nior*, *chatr*, *romūsk*, Pb.; *Tsāpo*, *māil*, Tibet, Spiti; *Chato*, *chedwala*, *chadua*, N.W.P.

Branchlets generally spinescent, young parts pubescent. Leaves and branchlets generally opposite. Leaves frequently fascicled on short undeveloped branchlets; lanceolate, ovate-lanceolate, ovate or obovate. acuminate, 1-4 in. long, narrowed into petiole ¼-⅓ in. long, serrate or crenate, with 3-6 arcuate and converging lateral nerves on either side of midrib, the lower pair from near the base of leaf. Flowers greenish on slender pedicels, 4-5-merous, crowded in the axils of fascicled leaves, or at the base of branchlets. Flower-buds ovate-lanceolate ; calyx-tube campanulate or turbinate ; petals minute linear or spathulate ; style filiform, 2-4-cleft, the branches recurved. Drupes 2-3-celled ; seeds grooved, groove narrow, nearly closed.

Trans-Indus territory, chiefly on and near the base of the hills. Himalaya, from 2400-7000, at times to 9500 ft., from the Indus to Bhutan, Nilgiris, and other hills near the Western Ghats, also in China. The leaves fall early, the fresh foliage appearing in May and June, often after the flowers. Fl. more or less at all seasons, but usually April-June, the fruit ripening from October during the cold season.

A large shrub, or a small tree, 15-20 ft. high, with much-ramified branches, long and straight branchlets, forming a dense rounded crown. Bark finely variegated, smooth with slight longitudinal wrinkles, the shining epidermis often peeling off. Heartwood distinct, of a bright red-brown or chocolate colour, strong, hard, and heavy. The fruit is bitter, emetic and purgative, given (trans-Indus) in affections of the spleen.

This species is closely allied to *R. catharticus*, L., the common *Buckthorn* of England, which is found nearly all over Europe, and occurs in North Africa and Siberia. The only points of difference seem to be that the leaves of *R. catharticus* frequently have a cordate base, and that the drupe is frequently 4-seeded.

4. **R. persicus**, Boissier Fl. Orient. ii. 17.—Vern. *Sherawane*, *wurak*, Afg. ; *Kūkei*, *nār*, *nikki kander* (small thorn), *jalidar*, *kūchni*, Pb.

Spinescent or unarmed ; leaves and branches alternate. Leaves coriaceous, ovate obovate or oblong, short-petiolate, entire or serrate, pubescent or short-tomentose, lateral nerves 2-5, not prominent. Flowers axillary, tetramerous, diœcious, on short pedicels ; petals small, linear ; style 2-4-cleft at the top. Drupe supported by the flat circular base of calyx ; seeds with a shining testa, grooved on the back with a wide open groove, the edges of it thickened and bent inward at the top.

Persia. Beluchistan. Eastern flank of the Suliman range, the Salt range, and outer Himalaya, from the Indus to the Chenab, at an elevation from 2000-5000 ft. (A variety—or distinct species—is a small depressed spinescent shrub, in the arid Tibetan tract of the Himalaya between 9000 and 14,000 ft. Nubra, Ladak, Upper Chenab and Sutlej basin, and Upper Kamaon.) Nearly leafless for some months ; the fresh foliage issues about April and May. Flowers at all seasons, frequently before the leaves come out. The fruit ripens about November, is sweet and edible, but emetic. Trans-Indus it is boiled for two days, and administered in affections of the spleen.

In the plains and lower hills, in arid rocky places, grows to a small tree 20 ft. high, with a short, erect trunk, and a rounded crown of stiff divergent branches. Bark yellowish or dark cinereous, smooth, at times with a whitish, shining, thin, exfoliating epidermis.

This species is closely allied to *R. oleoides*, L., a small spinescent shrub common in South Europe and North Africa. The main difference is that *oleoides* is always glabrous, and that the leaves are 1-nerved, with reticulate veins. There is also some affinity to *R. spathulæfolius*, Fisch. et Mey., from the Caucasian provinces.

Another species, *R. procumbens*, Edgew. Trans. Linn. Soc. xx. 43, a small prostrate shrub, with coriaceous elliptic-lanceolate, sharp-serrate leaves, and persistent stipules, axillary, solitary, pentamerous flowers without petals, on slender pedicels, is found between 7000 and 8000 ft. about Simla, on the Deoban range, and in Kamaon.

4. HOVENIA, Thunb.

A tree, unarmed; leaves alternate, without stipules. Flowers in axillary pedunculate cymes, pentamerous, bisexual. Calyx broad-obconical; segments ovate, thick, with an elevated median line inside, deciduous after flowering. Petals shortly unguiculate, obovate-spathulate. Stamens opposite to petals on the edge of disc; anthers attached at the back, 2-celled, bursting longitudinally. Disc fleshy, coating the calyx-tube, surrounding the ovary, densely woolly. Ovary 3-celled, with an erect ovule in each cell, narrowed into 3 erect styles, more or less coherent. Drupe nearly dry, 3-celled, 3-seeded; endocarp thin, crustaceous, brittle. Seeds with a hard, shining, dark olive green, thick testa, a fleshy albumen, a straight embryo, with flat foliaceous, orbicular cotyledons.

1. **H. dulcis**, Thunb.; Siebold et Zuccarini, Flora Japonica, t. 73, 74; Roxb. Fl. Ind. i. 630.—Vern. *Chamhūn*, Ravi. Pb.

Pubescent; leaves alternate, deciduous, petiolate, ovate, long-acuminate, serrate, with 3-5 lateral, often alternate nerves on either side of midrib, the lowest pair proceeding from the base. Flowers white. The ramifications of cymes and fruit-stalks swell into an irregularly and unevenly oblong fleshy mass, much and variously bent, sweet-aromatic, the pedicels remaining dry and slender.

Commonly cultivated in Nepal, Sikkim, Bhutan, Assam, China, and Japan, also here and there in Kamaon, and (rarely) in the Panjab Himalaya (a few miles north of Chamba, at 4000 ft., and, according to Falconer, but not found since, in Hazara). Wallich considered the tree indigenous in Nepal, and Royle states that it certainly is wild at 6500 ft. in forests near Mussoori; but Buchanan (in 1802) wrote from Katmandu that the tree was originally brought from China, or some country subject to China. Grows to be a moderate-sized tree, 30 ft. high, with an erect, straight stem, attaining a large girth, and a large broad, rounded crown. Fl. April-May; the fruit ripens in July. The wood is light-coloured, coarse and open-grained. The tree is cultivated on account of its fruit, which has a pleasant flavour, like that of a Bergamot pear.

5. SAGERETIA, Brongniart.

Unarmed or spinescent shrubs, with leaves and angular branches generally opposite, or the upper alternate, penniveined leaves and small deciduous stipules. Flowers small, pentamerous, bisexual, in small sessile clusters, supported by bracts, in terminal or axillary panicles. Calyx flat; segments keeled inside, persistent. Disc lining the calyx, upper part free, thick, fleshy, annular or cup-shaped. Petals and stamens inserted on the calyx. Petals short-clawed. Ovary 3-celled, narrowed into 3 short coherent styles. Fruit a drupe with 3 coriaceous, indehiscent kernels. Seeds completely filling the kernels, with a straight embryo, cotyledons foliaceous, enclosed by a thin fleshy albumen.

Leaves acuminate; lateral nerves 4-8 pair . . 1. *S. oppositifolia.*
 Leaves acute or obtuse; lateral nerves 2-4 pair.
  Under side of leaves covered with a dense white woolly tomentum . . . . . . 2. *S. Brandrethiana.*
  Under side of full-grown leaves glabrous . . 3. *S. theesans.*

1. **S. oppositifolia,** Brongn. — Syn. *Zizyphus oppositifolia,* Wall. in Roxb. Fl. Ind., ed. Carey, ii. 370. Vern. *Kanak, gīdardāk* (jackal's vine), *drānge, girthan,* Pb.; *Aglaia,* Kamaon.

Armed with short spinescent branchlets. Leaves short-petiolate, silky-tomentose when young, glabrous afterwards, coriaceous, ovate-oblong, acuminate, serrate, 2-4 in. long, with 4-8 pairs of lateral, arcuate nerves. Flowers in terminal panicles and lateral racemes, ramifications covered with short pubescence. Bracts 3-10 under each cluster, ovate, brown, ciliate. Calyx-lobes brown, persistent. Drupe turbinate, not lobed, ¼ in. long, black when ripe.

Common in the North-West Himalaya, alt. 2000-6000 ft.; from the Indus to Bhutan, also in the Konkan and on the Nilgiris. Fl. at various seasons, chiefly in autumn; the fruit, which is sweetish and edible, ripens in spring and summer. A large shrub or small tree, branches often climbing, angular, pubescent. Bark of stem and larger branches cinereous, often white speckled and fairly smooth.

2. **S. Brandrethiana,** Aitchison; Linn. Journ. viii. 62; Boissier Fl. Orient. ii. 22.—Vern. *Momanna, maimūna, nūmāni,* Afg.; *Ganger, Kanger, goher, koher,* Pb.

Armed with numerous spinescent branchlets; under side of leaves, young branches, and ramifications of inflorescence covered with a dense white woolly tomentum. Leaves on short petioles, elliptical, 1 in. long, entire or slightly dentate, glabrous above, lateral nerves 2-4 pair. Flower-panicles terminal and axillary. Bracts small, brown, ovate. Drupe ovoid, obtuse, trisulcate, size of a small pea or black currant, succulent, with raised longitudinal nerves, black when ripe.

Abundant on the east side of the Suliman range, in the Salt range, and at places in the outer N.W. Himalaya, between the Indus and Jhelam; also in Afghanistan, Beluchistan, and Muscat. Fl. usually from January-April, the fruit ripening about May. A shrub, at most 10-12 ft. high, branches stiff, divergent; the younger decussate, and often spinescent. Bark of larger branches glabrate, with a thin, white, shining epidermis, exfoliating while young. The foliage easily distinguished by the dark green upper- and white tomentose under side of the leaves. The fruit is sweetish, and is a great favourite with the Afghans; it is sold in bazaars of the frontier districts, and in some places a condiment is made of it.

3. **S. theesans,** Brongn.; Benth. Fl. Hong Kong, 68.—Vern. *Drangu, ankol, kauli, karūr, phomphli, kānda, brīnkol, chaunsh, katrāin, thūm, kūm,* Pb.

Branchlets often spinescent, glabrous, or young parts pubescent. Leaves short-petioled, elliptic or ovate, more or less distinctly serrate, 1-1¼ in. long, with 3 or 4 pairs of distant lateral nerves, glabrous, shining on both sides, pale beneath. Flowers in terminal and lateral panicles. Bracts brown, ovate. Fruit globular, the size of a small pea, irregularly rugose, dark brown when ripe.

Common in places on the eastern flank of the Suliman range, at between 2000 and 8000 ft.; in the Salt range, and in the North-West Himalaya, between 3000 and 8000 ft., from the Jhelam to the Sarda; also in China and Japan. Fl. August-November. A small shrub 6-8 ft. high; the bark of older branches grey or brown, with small white lenticels and shallow longitudinal furrows. The fruit is eaten in parts of the Himalaya, and in China. The leaves are used as tea by the poorer classes in China.

6. VENTILAGO, Gærtn.

Climbing, unarmed shrubs, with alternate, simple, petiolate leaves. Flowers small, pentamerous, bisexual, in terminal or axillary panicles. Calyx-segments keeled inside. Petals hooded, deflexed. Stamens adnate to the base of the petals. Disc pentagonal, margin free. Ovary immersed in the disc, 2-celled; style very short. Fruit a subglobose nut, prolonged into an apical, linear, coriaceous wing, 1-celled, 1-seeded. Seed subglobose, exalbuminous, with a membranous testa; cotyledons thick, fleshy; radicle inferior, very short.

Lower half of fruit enclosed in the cup-shaped calyx .	1. *V. calyculata.*
Remains of calyx forming a flat disc at the base of fruit	2. *V. maderaspatana.*

1. **V. calyculata**, Tulasne.—Syn. *V. maderaspatana;* Roxb. Cor. Pl. t. 76; Fl. Ind. i. 629. Vern. *Papri*, C.P.; *Rakat-pita*, *kala lag*, Kamaon.

A large climbing shrub, with woody tendrils; branchlets, petioles, the younger leaves, and inflorescence pubescent. Leaves glabrate, subcoriaceous, elliptic-oblong from an oblique base, acuminate, irregularly dentate or entire; main lateral nerves 6-8 on either side of midrib, arcuate, anastomosing by numerous fine parallel and distinct intramarginal veins; blade 3-4 in.; petiole less than ¼ in. long. Flowers numerous, small, greenish, with a strong and offensive smell, in long, terminal, leafless panicles. Nut subglobose, ¼ in. diam., girt about the middle by the rim of the adnate calyx; wing linear, 2½ in. long, pubescent, terminated by the remains of the bifid style.

Bengal, Central India, Western Ghats, Oudh forests, Rohilkhand, and sub-Himalayan tract to the Jumna—climbing to the top of the tallest trees. Fl. March. Seed ripens May.

V. Bombaiensis, Dalzell Bomb. Fl. 48, probably belongs to this species.

2. **V. maderaspatana**, Gærtner; Wight Ic. t. 163; W. & A. Prodr. 164.—Vern. *Lokandi*, *kanwail*, Bomb.

A large climbing shrub; leaves ovate, acuminate, coriaceous, shining, pubescent while young. Nut globose, ⅙ in. diam., the remains of calyx forming a flat disc at the base; wing linear, 1-2 in. long, glabrous, shining.

South India, Ceylon, Burma, Ind. Archipelago. Fl. C.S. Cordage made of the bark. The root of this or the preceding species is collected and used as a red dye in Mysore, Salem, and Bellary (vern. *Popli-chukay,* Mysore), Buchanan i. 168.

ORDER XXVI. AMPELIDEÆ.

Shrubs, erect or climbing; leaves alternate, petiolate, simple or compound. Flowers regular, small, in cymose panicles, racemes or spikes, terminal or leaf-opposed. Calyx small, entire, 4-5-dentate or -lobed. Petals 4 or 5, hypogynous, small, valvate in the bud, distinct or cohering at the base or at the top. Stamens as many as and opposite to the petals, hypogynous, free and distinct or monadelphous. Ovary 2-6-celled, with 2 erect collateral ovules, or a single ovule in each cell. Style simple, often very short, or stigma sessile. Fruit a berry, with 1 or few bony seeds. Embryo very small, in the base of a copious albumen.—Gen. Pl. i. 386; Royle Ill. 144; Wight Ill. i. 149.

Woody or herbaceous climbers; filaments free; ovary 2-celled . . . 1. VITIS.
Erect shrubs or large herbs; filaments united in a tube; ovary 3-6 celled 2. LEEA.

1. VITIS, Linn.

Vines, branchlets tumid at the nodes. Tendrils and peduncles generally leaf-opposed, tendrils rarely wanting. Leaves alternate, or the lowest opposite, entire palmately lobed or compound; leaflets pedate, ternate, or quinate. Stipules membranous, deciduous. Flowers numerous, cymose. Inside of calyx filled with a fleshy torus, which expands around the base of the ovary into a 4-5-lobed hypogynous disc. Petals 5 or 4, inserted under the edge of the disc, their summits frequently induplicate and slightly cohering, when the whole corolla, lifted up by the stamens, separates from the base, and falls away together; sometimes expanding in the ordinary way, early deciduous. Stamens free, inserted with the petals; filaments distinct; anthers cordate-ovate, fixed near the middle, 2-celled, the cells opening longitudinally. Ovary sessile, 2-celled, its base surrounded by the fleshy disc. Fruit a 2-celled (or by abortion 1-celled) globular berry, the cells 2-seeded, or by abortion 1-seeded. Seeds obovoid, the membranous testa covering a thick, bony, inner integument. Albumen cartilaginous-fleshy.

Numerous climbers in the Indian forest belong to this genus. It must here suffice to enumerate a few of the larger ones in North and Central India. Few Indian genera demand more study on the spot, and the following arrangement is by no means satisfactory:—

Leaves simple; fl. pentamerous, in thyrsoid panicles.
Branches glabrous or with deciduous tomentum; leaves suborbicular.
Panicles leaf-opposed, occasionally cirrhiferous; fl. green; petals cohering . . . . 1. *V. vinifera.*
Panicles on leaf-opposed tendrils; fl. deep reddish brown; petals distinct . . . . 2. *V. latifolia.*
Branches glabrous; leaves ovate, longer than broad . 3. *V. parvifolia.*

Branches densely tomentose.	
Flowers in large compound panicles; petals connate .	4. *V. lanata.*
Flowers in compact cylindrical racemes; petals distinct	5. *V. indica.*
Leaves simple; fl. tetramerous, in dichotomous cymes .	6. *V. adnata.*
Leaves simple; stems fleshy, quadrangular; fl. tetramerous	7. *V. quadrangularis.*
Leaves trifoliolate.	
Flowers pentamerous	8. *V. himalayana.*
Flowers tetramerous, in leaf-opposed cymes; leaves rough	9. *V. carnosa.*
Flowers tetramerous, in axillary cymes; leaves glabrous .	10. *V. lanceolaria.*

1. **V. vinifera,** Linn.; W. & A. Prodr. 130. The grape vine.—Sans. *Drāksha*;. Arab. *Ainab;* Pers. *Angūr.* Vern. *Dākh, dakki, drāksha, angūr.* Local, *Lānang* (fruit, *dakhang*), Kunawar.

A large woody climber, with long, bifid tendrils. Leaves glabrous above, clothed beneath with grey, floccose, deciduous tomentum, suborbicular with cordate base, more or less deeply 5-lobed, edge cut into large, unequal, acute teeth; basal nerves 5, the midrib with 4-5 pair of prominent main lateral nerves. Petiole generally shorter than leaf, but longer than half its length. Flowers green, fragrant, pentamerous, on slender pedicels longer than flower, in umbelliform cymes, which form large pyramidal compound panicles, one of the lower branches of the inflorescence sometimes terminating in a short tendril. Bracts oblong, early deciduous. Petals oblong, cohering at the top, separating from the base, and raised by the development of the stamens.

Indigenous in Armenia, the Caucasus, other parts of Western Asia, and probably also in Bulgaria, Thracia, and Greece, where the vine is found as a large woody climber on *Ostrya, Fraxinus, Platanus,* and other trees, in shady forests and moist valleys. In the N.W. Himalaya, also, the vine is often found apparently wild, but it is not always easy to distinguish it from some of the other species (Thoms. West. Him. 348). The native country of the vine cannot precisely be defined, for whenever cultivated under favourable climatic conditions, it spreads readily. So much, however, is certain, that its cultivation, both in Syria and Greece, is as old as the oldest historical records which we possess of those countries; that Greek colonists and traders imported it into Italy at an early age (*οἶνος, vinum*); that from Western Asia and South-Eastern Europe its cultivation has gradually spread over the rest of Europe; and that from Europe it has been introduced to the Cape, temperate Australia, and North America.

The present northern limit of vineyards on a large scale is at 47° 30′ N. lat. in the Bretagne, and thence runs eastward, slightly tending towards the north, crossing the Rhine at lat. 50° 45′, and attaining its northernmost point in Silesia at lat. 51° 55′.—(Grisebach, Vegetation der Erde, i. 126.) The comparison of this line with the lines of equal temperature during the different seasons, shows that it is the want of sufficient summer-heat which prevents its profitable cultivation further north in Western Europe. In the middle ages, however, there were vineyards in the south of England, and not far from the Baltic. In India, extensive vineyards were formerly in Kunawar, from Jani to Sangnam (between 5500 and 9000 ft.), and in some of the other inner and drier valleys of the N.W. Himalaya. But the vine disease broke out in these secluded valleys (between 1855 and 1860), and since then the cultivation has greatly diminished. Excellent grapes are grown in Kashmir, the plains of North-West India, the Dekkan, and in other parts of India, but not in the moist tropical climate of the western coast below Ghat, and of the Burma coast. Nor does the grape vine bear well in Lower Bengal. In the Himalaya the grape ripens in September, in the plains of the North-West in June, and in the Dekkan in March. In the Mauritius the vine flowers twice, in Apr. and Sept. (Bojer, Hort. Maur. 60). The wood of the vine is remarkable by its numerous large medullary rays and exceedingly numerous pores, giving it the appearance of a sieve. In spring it yields an abundance of clear watery sap, which rises with great force, and several Indian species do the same.

2. **V. latifolia,** Roxb. Fl. Ind. i. 661; W. & A. Prodr. 130.—Syn. *Cissus latifolia,* Vahl; Dalzell & Gibson, Bomb. Fl. 39.

A large herbaceous climber, from a perennial root-stock. Tendrils long, bifid, often flower-bearing. Leaves tomentose beneath, suborbicular, with cordate base, angled or slightly 5-lobed, lobes dentate; basal nerves 5; the midrib with 3-5 pair of prominent main lateral nerves. Petioles shorter than leaf. Flowers pentamerous, deep reddish brown, on short thick pedicels, in compound pyramidal panicles 1-4 in. long, issuing from the middle of the tendril before it divides; petals distinct. Ovary 10-furrowed at the apex. Berry black.

Plains of North-West India, Sub-Himalayan tract (Sewaliks and Bhabar), as far as the Sutlej. Satpura range. The Konkan. Also in Bengal and South India. Fl. May-July. Madden, Journ. As. Soc. xvii. pt. i. 379, notices *V. latifolia* as "an immense climber, with cable-like stems, sometimes 2 ft. in diam." Vern. *Pan lagūla, Bhains-amli,* Kamaon. Is this another species? (perhaps *adnata.*)

3. **V. parvifolia,** Roxb. Fl. Ind. i. 662. Vern. *Berain,* Kamaon.

A slender vine, stem and old branches ligneous, branchlets glabrous. Tendrils bifid. Leaves glabrous, 2-3 in. long, 1-2 in. broad, ovate, acuminate, dentate or serrate, often more or less deeply 3-lobed; basal nerves 5, midrib with 2-3 pair of main lateral nerves. Flowers minute, green, pentamerous, on long slender pedicels, umbellate, the umbels arranged in a panicle, 1-2 in. long, leaf-opposed, or inserted on a tendril. Petals cohering at the apex.

Sub-Himalayan tract, and outer ranges from Kashmir to Bengal, ascending to 6000 ft. Fl. April, May.

4. **V. lanata,** Roxb. Fl. Ind. i. 660; W. & A. Prodr. 131. Vern. *Purain,* Kamaon.

Woody, climbing over high trees; branches, petioles, and peduncles woolly. Leaves ovate, from a flat or cordate base, acuminate, about 4 in. long, 3 in. broad, dentate, angled or indistinctly 3-lobed, densely clothed beneath with rusty or reddish soft tomentum. Flowers small, greenish, pentamerous, umbellate, on slender pedicels, in large compound leaf-opposed panicles, one of the lower branches often terminating in a tendril. Petals pale yellow, cohering at the apex. Fruit globose, the size of a pea, 1-seeded.

South India, Bengal, Sub-Himalayan tract, as far north as Hazara, ascending to 5000 ft. Fl. April, May. The stem yields an abundance of sap in Spring. (Madden.)

V. rugosa, Wall. Roxb. Fl. Ind. ed. Carey, ii. 480.—Vern. *Asoja paharphuta* (the mountain-splitter), creeps over crags and rocks in Kamaon at from

5000 to 6500 ft. (Madden Journ. As. Soc. vol. xvii. pt. i. 417), and resembles *V. lanata*, but differs by larger leaves 6-12 in. long, deep red flowers, the petals distinct, not cohering. Fl. July. Grapes edible, ripen Sept.-Oct. (whence the first vern. name). In W. & A. Prodr., this sp. is united with *V. lanata*.

5. **V. indica**, Linn.; Roxb. Fl. Ind. i. 660; W. & A. Prodr. 131.

A large climber; branches petioles and peduncles villose; leaves hard, firm, broad-ovate, 3-6 in. long, and of equal breadth, with a deep-cordate base, not lobed or angled, but large- and shallow-crenate, the nerves terminating in hard glandular teeth; under side rusty-tomentose, upper floccose, at length glabrous. Flowers minute, pentamerous, yellowish green or greenish purple, on slender pedicels, umbels sessile along the rachis of a short compact cylindrical raceme, inserted about the middle of a long bifid tendril. Petals distinct; fruit globose, 1-2-seeded.

South and probably Central India. Bengal. Fl. March, April.

6. **V. adnata**, Wall.; W. & A. Prodr. 126.—Syn. *Cissus adnata*, Roxb. Fl. Ind. i. 405; Wight Ic. t. 144.

A large woody climber, young parts densely pubescent. Leaves broad-ovate from cordate base, acuminate, angled, and sharp-dentate. Flowers tetramerous, greenish yellow, in rounded leaf-opposed cymes; petals distinct. Berry black when ripe.

Sub-Himalayan tract. Oudh forests, Satpura range. Bengal, South India. Fl. April-June. *C. rosea*, Royle Ill. t. 26, is nearly allied to this, but has pink flowers and larger leaves. Sewalik and Bhabar, Jumna to Sarda.

7. **V. quadrangularis**, Wall.; W. & A. Prodr. 125; Wight Ic. t. 51.—Syn. *Cissus quadrangularis*, Roxb. Fl. Ind. i. 407. Vern. *Harjōra*, Beng.

A perennial climber; stems and branches dichotomous, succulent, quadrangular, constricted at the nodes, the angles winged. Leaves fleshy, varying from ovate and entire to cordate and deeply 3-lobed. Tendrils long, generally simple, leaf-opposed. Flowers tetramerous, pink and white, in umbelliform cymes, on short, leaf-opposed peduncles. Petals distinct. Berry globose, size of a small pea, red, 1-seeded.

Common throughout tropical and subtropical India. Fl. R.S., fr. C.S. Berries very acid, leaves and tender shoots eaten. Dalzell, Bombay Fl. 40, calls this *Cissus edulis*, and a nearly allied species without wings in Guzerat (vern. *Harsanker*), he calls *Cissus quadrangularis*, Linn.

8. **V. himalayana**.—Syn. *Ampelopsis himalayana*, Royle Ill. 149. Vern. *Chappar tang*, Kamaon.

A large soft-wooded climber or scrambling shrub; glabrous, or youngest shoots slightly pubescent. Leaves trifoliolate, smooth, shining; leaflets equally stalked, acuminate, sharp-serrate or dentate with cuspidate teeth, the terminal leaflet ovate or obovate; main lateral nerves 6-10 pair, the two lateral leaflets very unequal-sided, falcate, or semicordate, all reticulate beneath with prominent veins. Stipules oblong, early deciduous. Flowers yellowish green, pentamerous, in compound, trichotomous, leaf-opposed, spreading cymes. Peduncles as long as, or shorter than, petiole of the opposite leaf.

Himalaya, 3000-9000 ft. (in Sikkim, to 11,000 ft.), from Kashmir to Assam Kasia hills, Pulney hills, Burma. Fl. April, May. Hardy in England.

9. **V. carnosa**, Wall.; W. & A. Prodr. 127.—Syn. *Cissus carnosa*, Roxb. Fl. Ind. 409.

A large climber, with herbaceous compressed stem, from a perennial rootstock. Young parts clothed with short pubescence. Leaves trifoliolate, rough; leaflets ovate or elliptic, the two lateral short-stalked, nearly sessile, often oblique, crenate-serrate, main lateral nerves 4-6 pair; stipules oblong. Flowers tetramerous, greenish white, in trichotomous, compound, leaf-opposed cymes; peduncles generally longer than common petiole of the opposite leaf. Petals distinct. Berries black, 2-4-seeded.

Common in hedges and forests in most parts of India and Burma, as far north as the Salt range and the Indus in the Panjab. Fl. July, Aug.

10. **V. lanceolaria**, Wall.; W. & A. Prodr. 128.—Syn. *Cissus lanceolaria*, Roxb. Fl. Ind. i. 412.

A large, evergreen, climbing shrub, glabrous, only inflorescence pubescent. Stems woody, with rough often muricated bark; tendrils leaf-opposed. Leaves trifoliolate, coriaceous; leaflets ovate or lanceolate, petiolulate, penniveined, 3-5 in. long, distantly serrate, acuminate. Flowers unisexual, pale yellow, tetramerous, in axillary, subsessile, dichotomous, compound cymes. Petals distinct. Fruit ovoid, ½ in. long.

South India, Oudh forests. Fl. March, April.

A trifoliolate vine is described by Madden, l. c. 379, 418, as *V. tomentosa* (Vern. *Chappertang, chappertain, cheprain, amila*), with red flowers, similar to those of *V. rugosa*. "Very common, reaching to 6000 ft. in Kamaon." *V. capreolata*, Royle Ill. i. 149 (*Cissus capreolata*, Don; Royle Ill. t. 26); Vern. *Pang pata*, Kamaon; is a slender climber, with pedate, 5-foliolate, glabrous leaves, common in the N.W. Himalaya, 4000-7000 ft. "Clinging to the trunks of trees as closely as the ivy" (Royle).

2. LEEA, Linn.

Herbs or shrubs, branches generally furrowed. Leaves alternate, rarely opposite, simple pinnate bipinnate or tripinnate; petioles with broad sheathing base. Flowers in compound cymes; peduncles leaf-opposed; no tendrils. Calyx 5-dentate. Petals 5, more or less cohering at the base, and adhering to the staminal tube. Stamens 5; anthers on short filaments, inserted on the outside of an entire or 5-cleft staminal tube. Ovary inserted on the disc, 3-6-celled; style short; one ovule in each cell. Fruit a 3-6-celled berry. Seeds erect; embryo small in a cartilaginous albumen.

Several species of this genus are large perennial herbs or herbaceous shrubs, characteristic of certain descriptions of forests in India. The following are found in the sub-Himalayan tract of N.W. India:—

Leaves pinnate, or the lower only bipinnate.	
Peduncle as long as cyme, or shorter . . .	1. *L. aspera.*
Peduncle several times longer than cyme . .	2. *L. alata.*
All leaves bipinnate	3. *L. sambucina.*
Leaves simple	4. *L. macrophylla.*

1. **L. aspera,** Wall.; Roxb. Fl. Ind., ed. Carey, ii. 468; Edgeworth Trans. Linn. Soc. xx. 36.—Vern. *Kumali, kurmali,* Kamaon.

A tall herbaceous perennial, 2-4 ft. high, pubescent. Leaves imparipinnate, the lower leaves often bipinnate; common petiole not winged; leaflets (pinnæ) 2-3 pair, ovate or ovate-oblong, acuminate, base cordate or rounded, 4-8 in. long, pale beneath, obtusely dentate, main lateral nerves 12-16 pair, joined by distinct intramarginal and numerous fine closely-parallel veins. Cymes sessile or short-pedunculate, with subulate, deciduous bracts. Anthers not adhering to each other; filaments inserted near the base of the staminal tube, alternating with its oblong, obtuse emarginate lobes. Berry black.

Forests of the Outer Himalayan valleys, ascending to 6000 ft. Bias to Nepal, Oudh forests, Satpura range. Fl. June, July.

2. **L. alata,** Edgew. l. c. 36.—Syn. *L. rubra,* Royle Ill. p. 145.

A large herbaceous perennial, glabrous, but rough with elevated dots. Leaves imparipinnate; common petiole furrowed, winged with narrow membranous wings; leaflets 3 pair, 6-10 in. long, oblong, acute, base acute or rounded, the upper 2 pair sessile, the lowest pair short-petiolate; petioles winged; main lateral nerves 8-12, joined by parallel, transverse, and intramarginal veins. Cymes compact, compound, on long peduncles more than twice the length of cyme; peduncles and ramifications of cymes red, furrowed, winged, and rough with elevated glandular dots. Anthers adhering to each other sideways; filaments inserted below the edge of staminal tube, alternating with its obovate lobes.

Siwalik and sub-Himalayan tract, from the Jumna to Sikkim, ascending to 3000 ft. Fl. R.S.

3. **L. sambucina,** Willd.—Syn. *L. Staphylea,* Roxb. Fl. Ind. i. 658; W. & A. Prodr. 132; Wight Ill. i. t. 58.

A shrub, with stout soft-wooded stems; glabrous. Leaves twice or thrice pinnate; pinnæ 2-3 pair; leaflets on short petioles, firm, hard, pale beneath, oblong ovate- or lanceolate-oblong, coarsely serrate, with 8-12 main lateral nerves; transverse veins not prominent. Stipules large, adnate to the base of petiole, coloured. Flowers greenish white, in large, trichotomous, divaricate cymes, on short peduncles. Berry black or dark-blue, size of a small cherry, depressed, 4-6-furrowed, 4-6-seeded.

Widely spread in the forests of tropical and subtropical India, probably in the forests of Oudh, Kamaon, and the Central Provinces. Tropical Asia, Upper Guinea, Queensland, and North Australia. Fl. R.S.

4. **L. macrophylla,** Roxb. Fl. Ind. i. 653; Wight Ic. t. 1154.

A large herbaceous perennial. Leaves broad-cordate, 12-20 in. long, deeply and unequally dentate, pale beneath, 8-12 pair main lateral nerves. Flowers small, white, in large terminal, compound cymes.

Forests of tropical and subtropical India, sub-Himalayan tract to the Ganges. Fl. R.S.

ORDER XXVII. **SAPINDACEÆ.**

Trees or shrubs, with alternate or opposite leaves, with or without stipules, and small flowers which are generally polygamous. Sepals mostly 4-5, imbricate, rarely valvate, more or less connate. Petals mostly 3-5 or none, imbricate, often hairy below. Disc complete or 1-sided. Stamens hypogynous, 5-10, generally 8, the filaments often hairy. Ovary 1-4-celled, generally 3-celled; ovules 1-2 in each cell, on axile placentas. Fruit various; seeds generally without albumen.—Gen. Pl. i. 388; Royle Ill. 136; Wight Ill. i. 139.

Fruit coriaceous, 1-3-celled; leaves without stipules.
  Leaves opposite, palmately compound . . . . 1. ÆSCULUS.
  Leaves alternate, pinnate . . . . . . 2. SCHLEICHERA.
Fruit of 1-3 nearly distinct indehiscent carpels; leaves usually without stipules.
  Carpels not winged; leaves alternate, abruptly pinnate or unifoliolate . . . . 3. SAPINDUS.
  Carpels 2, with long wings at the back; leaves opposite, simple, entire or palmatifid . . . . . . 4. ACER.
Fruit a membranous, dehiscent, 2-5-celled capsule; leaves with or without stipules.
  Sepals 5, valvate; petals none; stamens 8; leaves simple, alternate, without stipules . . . . . 5. DODONÆA.
  Sepals 5, imbricate; petals 5; stamens 5; leaves opposite, trifoliolate or pinnate, stipulate . . . . 6. STAPHYLEA.

1. **ÆSCULUS**, Linn.

Trees with large scaly buds, and opposite, digitate, deciduous leaves, without stipules. Flowers showy, in an ample terminal thyrsus, polygamous, the fertile flowers generally near the base of the branches of the thyrsus, the others sterile by abortion of the ovary, otherwise similar; the pedicels articulate; bracts deciduous. Calyx campanulate or tubular, 5-lobed, deciduous, the lobes more or less unequal, imbricate in bud. Petals 5, alternate with the lobes of the calyx, often only 4 from the abortion of the fifth, hypogynous, unequal, imbricate in bud, deciduous. Disc hypogynous, lobed. Stamens 6-8, commonly 7, outer circle 5, alternate with petals, inner circle 1-3; filaments subulate or filiform; anthers versatile, introrse, with glandular tips at both ends, 2-celled, opening longitudinally. Ovary 3-celled; style slender, undivided; ovules 2 in each cell. Fruit a large leathery capsule, 1-3-celled, the cells 1-seeded, loculicidally 2-3-valved. Seeds large, with a smooth, shining, coriaceous testa, and a broad opaque hilum. Albumen none; cotyledons thick, fleshy, more or less corrugate, and coherent by their contiguous faces, unequal, incumbent on the short conical radicle, plumule conspicuous, 2-leaved. The cotyledons remain in the coriaceous testa whilst the seed germinates.

1. **A. indica**, Colebrooke.—**Tab. XIX.**—Syn. *Pavia indica*, Wall.; Jacquemont Voy. Bot. t. 35. *The Indian Horse-chestnut.*—Vern. *Seutoalla*, Kaffiristan; *Torjaga*, Trans-Indus; *Hāne*, *hanūdūn*, Kashmir; *Ban-khor* (forest-walnut), *gūgu*, *kanor*, Pb.; *Pānkar*, N.W.P.

Leaflets 5-9, generally unequal, the centre leaflets longer, 6-9 in. long, glabrous, oblong, acuminate, sharp-serrate, petiolule ½-1 in. long. 15-20 alternate, arcuate, lateral nerves on either side of midrib. Thyrsus 12-15 in. long, composed of numerous scorpioid cymes on short peduncles; pedicels and calyx covered with grey, mealy pubescence. Calyx tubular, frequently splitting as the flower opens, with 5 short, obtuse, unequal teeth, one obcordate, larger than the others. Petals 4, white and yellow, clawed, lamina obcordate; 2 petals narrower than the rest. Stamens 7; filaments filiform, longer than petals. Disc unilateral. Capsule ovoid or obovoid, 1-2 in. long, brown when ripe, reddish brown when young, somewhat rough outside, but not echinate. Seeds dark brown or black.

Wild in Kaffiristan at 7000-8000 ft., in the forests on the Trans-Indus hills north-west of Peshawar, and common in many parts of the North-West Himalaya at 3400-9000 ft., from the Indus to Nepal. Never entirely bare of leaves. Flowers appear about April and May, when the tree, loaded with the large upright panicles of variegated blossoms, presents a very striking appearance. The fruit ripens between July and Oct.

The North Indian horse-chestnut is not a gregarious tree, but is often found in large numbers, particularly in moist and shady valleys. The trunk is short, attaining large girth (12-15 ft., occasionally 25 ft.) Numerous large boughs, spreading into a broad, depressed, close, umbrageous crown 40-50 ft. high, much resembling in habit the common horse-chestnut. The bark of trunk and large boughs is thick (¾-1 in.), the inner half light-yellowish brown, soft and brittle, the outer darker brown and more fibrous. Outer surface grey or dark brown, divided by numerous long shallow furrows into long quadrangular plates, often winding spirally round the trunk. When old, the outer layers partly peel off upwards in long strips, leaving exposed a smooth grey surface. The wood is light brown, soft, open-grained, not much valued, but used in the hills for building, for water-troughs, platters, packing-cases. Has been found to answer well for tea-boxes. The Tibetan drinking-cups are sometimes made of this wood.

The twigs and leaves are largely lopped for winter fodder in the Himalaya and Kaffiristan. Cattle and goats feed on the fruit. The seeds contain an abundance of starch combined with a bitter principle. In times of scarcity they are used as food, ground and mixed with flour, after having been steeped in water for some time.

Closely allied to this species is *A. punduana*, Wall., *A. assamica*, Griff., the horse-chestnut of Sikkim, Assam, and the Kasia hills; also found by me in the Thoungyeen forests of Tenasserim, with larger, more coriaceous, obovate-oblong leaves, nearly sessile, and the thyrsus composed of long-pedunculate scorpioid cymes.

Æsculus Hippocastanum, Linn., the common horse-chestnut, which has been cultivated in Europe ever since the sixteenth century (1576 in Vienna), has echinate capsules, 4 or 5 broad petals, larger leaflets, woolly when young, with double serratures, and prominent lateral nerves. The common horse-chestnut is supposed to be indigenous in India (Boissier Fl. Orient. i. 947). Of this, however, there is as yet no proof, and its original home is unknown. It is found in Persia and the Caucasian region, but not really wild.

2. **SCHLEICHERA**, Willd.

Trees with alternate pinnate leaves, without stipules. Flowers fasciculate, polygamous. Calyx small, 4-6-cleft. Petals none. Stamens 6-8, longer than calyx, inserted near the centre of a flat, undulate, indistinctly lobed disc ; anthers 2-celled, dehiscing longitudinally. Ovary ovoid, 3-4-celled, narrowed into a rigid style ; stigma capitate, 3-4-cleft, divisions recurved ; one erect ovule in each cell. Fruit dry, coriaceous, indehiscent, 1-3-celled. Seeds enclosed in a fleshy arillus ; embryo conduplicate, the cotyledons unequal and closely coherent.

F 1. **S. trijuga**, Willd.—**Tab. XX.**—Bedd. Fl. Sylv. t. 119 ; Roxb. Fl. Ind. ii. 277 ; W. & A. Prodr. 114.—Vern. *Kosum*, *kossum*, *kussumb*, *gausam*, *kūsam*, North-West and Central India ; *kassuma*, *Koham*, *kocham*, Panch Mehals ; *Sagdi marra*, Can. ; *Gyoben*, Burm.

Young parts downy. Leaves abruptly pinnate, coriaceous when old ; leaflets 2-4 pair, opposite, sessile, oblong, entire, obtuse-acute or short acuminate, with 10-18 main lateral nerves on either side of the midrib, and intermediate shorter nerves ; the leaflets of the lowest pair 1-3 in., of the terminal pair 6-9 in. long. Flowers yellow, on short pedicels, fascicled on interrupted, often branched, racemes. Racemes axillary, or below the leaves, often several on short branchlets. Male and bisexual flowers generally on different trees. Fruit the size of a nutmeg, pointed, often echinate. Seeds 1 or 2, with a smooth brown testa, enclosed by a pulpy arillus, which has a pleasant acid taste. The cotyledons full of fat oil.

Common in the dry forests of Southern, Central, and Eastern India, at elevations below 3000 ft. In North-West India it is found in the Oudh forests and the Siwalik tract, where it ascends to 3000 ft., its western limit being the Sutlej river. It is grown in gardens near Lahore, and in Sindh. The Kosum is not a gregarious tree ; it grows singly, or a few together, mixed with the other trees of the dry forest. The old leaves are shed in Feb., the young foliage comes out in March, affording a grateful shade when the other trees of the dry forest are still leafless. The young leaves are purple at first, then light green, the old foliage has a deep green colour. The fl. come out with the young leaves.

A large tree, attaining 60-70 ft. in South India and Burma, smaller in Central and North India. Trunk scooped out longitudinally, with deep and irregular furrows, 5-6 feet in girth (to 12 ft. in Burma and South India), often hollow when large, with a few large ascending boughs, forming a broad rounded crown. Bark ½ in. thick, ash-grey or greyish brown, marked by shallow hollows, left by oblong, exfoliating scales.

Heartwood distinct, red or reddish brown, very heavy, close-grained, hard, tough, and strong. Pores scanty, small, uniformly distributed. Medullary rays very numerous, very fine. Seasons well, takes polish, and is very durable. Weighs between 66 and 70 lb. per cub. ft. Valued where strength, hardness, and durability are required. Oil, rice, and sugar crushers, pestles and mortars, rollers, screws, and the teeth of harrows are made of it ; it is also used in building, and for various parts of carts and ploughs.

In many parts of India, Lakh is produced on the young branches : at Mirzapūr the Lakh of this tree is stated to be the best, and to keep good for 10 years ; while the Lakh of other trees is said to last 2 years only. In Oudh this tree is lopped, and the twigs and leaves are used as cattle-fodder during the dry season. Oil is extracted from the seeds in South India and Ceylon.

3. **SAPINDUS,** Linn.

Trees or shrubs, with alternate, abruptly pinnate, or unifoliolate leaves, without stipules. Flowers polygamous, in terminal or axillary panicles. Calyx of 5 somewhat unequal sepals, connate at base, imbricate in bud, deciduous. Petals 4 or 5, nearly equal, alternate with the sepals, claw thickened, and often with one or two scales on the inside. Disc fleshy, cup-shaped or flat, circular, hypogynous. Stamens generally 8-10, inserted in the centre of the disc round the ovary, or in the male flowers round the rudiment of the ovary; filaments hairy; anthers versatile. Ovary generally 2-4-lobed, usually 3-celled; ovule solitary in each cell, erect from the base, or ascending from the inner angle above the base. Fruit fleshy or coriaceous, consisting of 1-3 distinct indehiscent carpels. Seed globose; hilum inferior, without arillus; the embryo incurved or straight; cotyledons fleshy; radicle short.

Several species of this genus are cultivated in North and Central India on account of the fleshy pulp of the fruit, which contains a peculiar substance, saponine, with properties in many respects similar to soap. The pulp makes a lather with water, and is used extensively for washing, either by itself, or mixed with soap. For flannel and Kashmir shawls it is greatly preferred to soap, and some varieties are specially esteemed for washing silk. In Bengal, Central and Northern India, the tree is generally known under the name of *Rītha*, and the Sanskrit name is *Arishta*. The species and varieties of this genus will repay further study. Three species are here enumerated, in accordance with Roxburgh's Flora Indica, but it is probable that the two first should be united into one species.

Leaflets 4-6, generally opposite; main lateral nerves 6-12; disc and ovary hirsute; anthers oblong, apiculate.
  Leaflets ovate or oblong, acuminate . . . . . . 1. *S. laurifolius.*
  Leaflets ovate, obovate or oblong, obtuse or emarginate . . 2. *S. emarginatus.*
Leaflets 8-14, generally alternate; main lateral nerves 20 or more; disc and ovary glabrous; anthers ovate, not apiculate . . 3. *S. detergens.*

1. **S. laurifolius,** Vahl; Roxb. Fl. Ind. ii. 278; W. & A. Prodr. 111.

Leaflets ovate or oblong, acuminate, 2-3 pair, those of the terminal pair longest, 3-7 in. long, glabrous above, soft pubescent beneath; main lateral nerves 8-12 on either side of the midrib, with a few shorter intermediate ones. Ramifications of inflorescence and calyx clothed with rusty pubescence. Cymes generally 3-flowered, supported by 3 short bracts, lateral flowers often abortive. Male flowers numerous, bisexual flowers few, often on distinct branches. Sepals 5, obtuse, imbricate, 2 outside, 2 inside, 1 intermediate, the left edge overlapping. Petals 4 or 5, oblong or lanceolate, outside with adpressed tawny hairs, inside glabrous, but with long white hairs along the edge, with a membranous scale fringed with a dense mass of long white hairs, more or less attached to the claw and inner surface of the petal, probably free when quite young, sometimes attached along the middle line only, and free at the sides, in which case it happens that the two edges of the scale separate from the middle part, and appear as lateral appendices. In the descriptions quoted (Fl. Ind. and Prodr.), the petals are said to be without scales. Beddome

(Fl. Sylv. p. 73) correctly states that the petals are sometimes furnished with 2 hairy glandular appendages. Disc concave, with a raised fleshy, hirsute edge. Stamens 8 inside the disc; filaments pilose; anthers oblong, apiculate. Ovary 3-lobed, covered with dense rusty tomentum. Drupes fleshy, 2 or 3, slightly united, each the size of a cherry.

2. **S. emarginatus**, Vahl; Roxb. Fl. Ind. ii. 279; W. & A. Prodr. 111; Bedd. Fl. Sylv. t. 154; Wight Ill. t. 51.

Leaflets ovate obovate or oblong, obtuse or emarginate, 2-3 pair, the terminal longest, 3-5 in. long, glabrous above, soft tomentose beneath; main lateral nerves 6-10, with a few shorter intermediate ones. Petals oblong or obovate, edge with long white hairs, with two thick tufts of white hair on either side at the top of the claw, attached to scales more or less coherent with the claw. On further examination, the petals and their scales will possibly be found the same in these two species, and then the only difference that will remain is in the shape of the leaf, which in this case would probably not be sufficient to keep them separate, and for all practical purposes, they may now be regarded as one species, which should be called *S. laurifolius*, Vahl.

The tree (*S. laurifolius* and *emarginatus*) is indigenous in South India. It is cultivated in Bengal and the North-West Provinces. Fl. from Oct. to Dec., and ripens its fruit from Feb. to April.

3. **S. detergens**, Roxb. Fl. Ind. ii. 280.—Syn. *S. acuminatus*, Wall. Vern. *Dodan*, *dodani*, *ritha*, Pb., N.W.P., Bandelkhand; *Kanmar*, N.W.P.

Leaflets 8-14, oblong or lanceolate, acuminate, generally alternate, the terminal leaflet smaller, coriaceous, glabrous on both sides, with numerous parallel lateral nerves close together, and shorter intermediate ones. Inflorescence consisting of numerous small, generally 3-flowered cymes, arranged in a terminal compound pyramidal thyrsus; ramifications pubescent or soft-tomentose; bracts small, linear. Numerous bisexual flowers mixed with male flowers. Calyx and petals purple, outside glabrous, with ciliate edges. Petals 5; lamina ovate, with 2 scales on either side at the top of the claw, covered with long white woolly hairs. Stamens 8; filaments covered with white woolly hairs; anthers ovate, not apiculate. Disc glabrous, flat, pentagonous, with 5 elevated radiating lines. Ovary 3-cornered, glabrous. Drupes fleshy, generally solitary, the size of a cherry.

Cultivated throughout North-West India, as far as the Chenab, but scarce near its north-western limit, ascending to 4000 ft. in the Himalaya. Also cultivated in Bengal. Royle speaks of it as wild in the valleys of the N.W. Himalaya, but its original home requires further inquiries. Fl. May, June, the fruit ripening from July onwards.

A handsome tree, 50-60 ft. high, with a straight trunk, attaining 8 ft. girth, numerous ascending branches, forming a close oval crown. Bark of trunk light or dark brown, with darker longitudinal furrows. The leaves are clustered near the ends of branches, and in autumn get partly yellow, which gives the tree a peculiar appearance. Wood whitish, with a red or yellow tinge considered valueless in the N.W. Himalaya. The leaves are given as fodder to cattle, the seeds are medicinal; but the valuable part is the saponaceous pulp of the fruit, which is an important article of trade in the Panjab and the North-West Provinces.

Another species of Sapindus (*S. Saponaria*, Linn., the West Indian *Soapberry*) is grown in the West Indies. The fruit (and the root) are used for the same purposes as *Rītha* in India; but Macfadyen, in his 'Flora of Jamaica' (i. 159), states that it is apt to burn and injure the texture of the cloth washed with it. It differs from *S. detergens*, by having the common petiole winged, and very thin membranous petals, with an orbicular lamina, without any scale or appendix.

Erioglossum rubiginosum, Blume (*S. rubiginosus*, Roxb. Cor. Pl. t. 62; Fl. Ind. ii. 282), probably occurs in Oudh and the Central Provinces. I have seen a specimen in bud from the Oudh forests, collected by Mr R. Thompson in 1871, which scarcely leaves any doubt regarding the identification. It is a native of Eastern Bengal, Burma, the hills of the Circars, and Beddome has found it in the Godavery forests (Fl. Sylv. 73). In Burma the tree is one of those called *Thitni* (red wood). Roxburgh states that the wood is strong and durable, chocolate-coloured towards the centre. In Oudh it is a large tree with a straight trunk, and a fine full head of foliage. The branchlets, inflorescence, and young leaves are clothed with dense rusty or golden tomentum; leaflets 8-15, alternate or sub-opposite, oblong-lanceolate, acuminate, main lateral nerves on either side, 8-12, the common petiole ending in a downy bristle; inflorescence a pyramidal thyrsus of long racemes, bearing small 3-5-flowered cymes with linear bracts, the bracts longer than buds, clothed with long rusty hairs; sepals 5, the 2 outer smaller, petals 4, longer than sepals, all on one side of the flower, bearing inside above the stalk a double scale half the length of the lamina; outer segment flat, inner segment thick, like a funnel-shaped tube slit open, the opening towards the inside of the petal; stamens 8; disc one-sided; ovary 3-lobed, hirsute. The Indian species is closely allied to, if not identical with, *Erioglossum edule*, Blume, a shrub or small tree in Java and the islands of the Indian Archipelago, the fruit of which is eatable.

4. ACER, Linn.

Trees, sometimes shrubs, with limpid, rarely milky sap, and scaly buds. Leaves opposite, usually exstipulate, deciduous. Flowers small, male and bisexual generally on different trees, in terminal panicles, racemes, or umbelliform fascicles. Bracts usually minute and caducous. Calyx 4-12- generally 5-parted, deciduous, the lobes imbricate in bud. Disc thick, annular, and hypogynous, or cup-shaped and more or less perigynous; margin free, lobed. Petals none, or as many as calyx-lobes, of the same colour, and alternate with them, equal, erect, short-clawed, deciduous. Stamens 4-12, generally 8, inserted on the disc; filaments commonly shorter in the bisexual, and longer in the male flowers; anthers introrse, 2-celled, the cells opening longitudinally. Pistil of two carpels, style deeply bifid, divisions linear or filiform, the inner face stigmatose; ovules 2 in each cell, attached to the inner angle. Fruit a double samara, consisting of 2 laterally-compressed nuts, at length separating from the small persistent axis, the back produced into a large, membranous, and reticulate wing, the lower edge of which is thickened. Seeds solitary, rarely 2 in each cell; albumen none. Embryo conduplicate, sometimes spirally convolute, the cotyledons irregularly folded; radicle generally long.

Of the genus Maple, upwards of 40 species are known, which are spread over Europe, Asia, and North America. Not less than 11 of these are found in the Himalayan region, 4 of which, *A. sikkimense*, Miquel, *Thomsoni*, Miq., *Hookeri*, Miq., and *Campbelli*, H. f. & T., belong to the Eastern Himalaya. Several of the N.W. Himalayan species have a wide range of distribution: *A. oblongum* is found in China; and *A. pictum*, Thunb., is known from India under the name of *cultratum*, Wall., from the Caucasus, Armenia, and North Persia, under the name of *lætum*, C. A. Meyer, and it is closely allied to *A. Lobelii*, Ten., from the mountains of South Italy. As regards their geographical distribution, the species of Maple may be divided into four large groups: first, those of Europe and Western Asia, of which *A. tataricum*, L., *pseudoplatanus*, L., *campestre*, L., *platanoides*, L., *opulifolium*, L., *monspessulanum*, L., are well-known species; secondly, those of the Himalayan region; thirdly, those of Japan, China, and North-East Asia; and fourthly, those of North America. Two species, *A. spicatum*, Lam., and *A. pennsylvanicum*, L. (*rufinerve*, Sieb. et Zucc.), are common to Japan and North America; the others, of which the Japanese and Chinese species, *A. palmatum*, and the North American, *A. saccharinum*, Wangenheim, may serve as instances, are at present only known as endemic. The following is a conspectus of the seven species, which are known from North-West India, but the present classification of this genus is imperfect. A revision will probably have the effect of basing it more upon the character of the inflorescence, the parts of the flowers, and possibly the structure of the seed. The inflorescence of Acer is mixed, cymes arranged in racemes or panicles.

I. Leaves undivided, rarely 3-lobed, penniveined, the lower 2 or 4 lateral nerves often proceeding from the base.
Petioles half or one-third the length of leaf; flowers in hairy corymbs . . . . 1. *A. oblongum.*
Petioles one-fourth the length of leaf, or less; flowers in lax glabrous panicles . . . . 2. *A. lævigatum.*

Allied to these two are—of Himalayan species, *A. sikkimense*, Miq., Sikkim, Bhutan, 7000-9000 ft.; *Hookeri*, Miq., Sikkim, Bhutan, and Assam; *Thomsoni*, Miq., Sikkim: and of the other species mentioned above, *A. tataricum*, L., a small tree with white flowers and red wings, which is at home in Eastern Europe, Russia, Western Asia, as far as Northern Persia, and has been found in Mantchouria and Japan.

II. Leaves 3-lobed, with 3, rarely 5 basal nerves; flowers in terminal fascicles . . . . 3. *A. pentapomicum.*

Of the species mentioned, *A. monspessulanum*, L., a shrub or small tree, of Middle and South Europe, Algeria, Syria, and Armenia, with small, coriaceous, 3-lobed leaves on long petioles, belongs to this group.

III. Leaves 5-lobed, with 5 basal nerves; flowers in racemes or panicles.
Flowers in long lateral racemes, appearing before the leaves; young leaves and inflorescence hairy . . 4. *A. villosum.*
Flowers appearing with or after the leaves in short racemes or corymbs.
  Lobes of leaves short-acuminate, with obtuse serratures; leaves pale beneath . . . . 5. *A. cæsium.*
  Lobes long-acuminate, with sharp serratures . 6. *A. caudatum.*

Near these are, of Indian species, *A. Campbellii*, H. f. & Th., from Sikkim; of the European Maples, the common Maple, *A. campestre*, L., with divaricate wings, small, obtuse-lobed leaves and erect corymbs; and the Sycamore, *A. pseudoplatanus*, with large leaves, pale beneath, and hanging racemes,—the first a moderate-sized, the second a large tree, common in Europe and Western Asia. Two other species of this group

A. spicatum, Lam., the Mountain Maple, and *A. pennsylvanicum*, L., the Striped Maple, are common to Japan and North America.

IV. Leaves 5- or 7-lobed, with 5 or 7 basal nerves; flowers in corymbs, umbels, or fascicles . . . . . . 7. *A. pictum*, Thunb.

Of European species, stand near to this *A. platanoides*, L., of North-Eastern and Middle Europe, the Caucasus, and Taurus region, the inner lobes of leaves with parallel sides, 3- or 5-cleft at the top; *A. opulifolium*, Vill., of South Europe, the Caucasus, and North Persia, the flowers in sessile fascicles, on long hairy pedicels: and of North American species, *A. saccharinum*, Wangenheim, the Sugar- or Rock-Maple.

There are other groups comprising North American and Japanese species, of which no representative forms are known from India.

1. **A. oblongum**, Wall.; Jacq. Voy. Bot. t. 34.—Vern. *Mark*, Pb.; *Patangalia, pharengala, kirmoli*, N.W.P.; *Mugila, buzimpāla*, Nepal.

Leaves oblong, acuminate, entire, green above, whitish-glaucous beneath; when young, with a few fine scattered hairs; when older, glabrous and coriaceous; main lateral nerves 4-8 pair, prominent, with finely-reticulated veins between. Petioles one-third or half the length of leaf. Flowers pentamerous, in terminal corymbs; ramifications, pedicels, and calyx hairy. Sepals and petals linear-oblong. Stamens 8, longer than calyx in the male flowers. Ovary hairy. Nuts unevenly gibbous; wings contracted at base, with a straight or somewhat curved back.

Siwalik tract and Outer Himalaya, ascending to 6000 ft. from the Jhelam to Bhutan, mostly in low valleys, in clumps of a few trees, not gregarious. Never leafless, the mature foliage of a fine dark-green colour. Fl. Feb.-Apr., the fruit ripens June-Nov. A moderate-sized tree 40-50 ft. high, attaining 5 ft. in girth. Bark dark blackish grey, smooth, with horizontal wrinkles. Wood light pink or reddish brown. Used for agricultural implements; some of the better drinking-cups in Tibet are said to be made of knobs of this wood. *A. laurinum*, Hasskarl, from Java, Sumatra, is similar, but apparently distinct.

2. **A. lævigatum**, Wall. Pl. As. rar. t. 104.—Vern. *Saslendi, cherauni*, Nepal.

Leaves oblong, acuminate, denticulate when young, entire when old, coriaceous, lucid on both sides, glabrous save a small brown tuft of hairs beneath in the axils of nerves; main lateral nerves 4-6 pair, joined by very prominent reticulate veins. Petioles short, less than ¼ the length of leaf. Flowers pentamerous, on long filiform pedicels, in lax terminal glabrous panicles; calyx glabrous; petals white, cuneate or obovate, distinctly unguiculate. Stamens 5-8, in the male flowers much longer than calyx, with a tuft of long hairs in place of ovary. Nuts smooth, oval; wings divergent, erect, or connivent, back curved.

Outer Himalaya 5000-9000 ft., from the Jumna to Sikkim, Kasia hills. Fl. Apr.; the fruit ripens July, Aug. A larger tree than *A. oblongum*, with a straight tall trunk 10-12 ft. in girth, branches spreading or hanging, forming a broad oval crown. Bark thick, smooth, yellowish or dark ash-coloured. In Nepal the wood is much used for building. *A. reticulatum*, Champ., Benth. Flora Hongkong. 47, from that island, is very similar to this species, but probably distinct.

3. **A. pentapomicum**, J. L. Stewart.—Vern. *Trekan(a), kūkandra, kak(a)rāi, kakkri, kitla, mandar(āi) kunghi, tīan, tilpatto, kīlpattar, serān,* Kashmir and Panjab.

Leaves broader than long, sometimes 3-5-lobed, with truncate base, and 3 prominent penniveined basal nerves; lobes spreading, oval acute or acuminate, obtusely dentate, separated by right-angled or acute-angled sinus, length of middle lobe about twice its width; the lower leaves often 5-lobed, with cordate base, and 2 additional smaller basal nerves. Petioles generally as long as leaf, glabrous when full-grown. Under side and petioles of young leaves clothed with soft tomentum, old leaves pale beneath, glabrous on both sides, or with short soft hairs beneath; tufts of hairs in the axils of basal nerves. Flowers not known, fruit in short corymbs, wings erect or divergent, semi-ovate, with straight back.

Common locally, and at times almost gregarious, between 2300 and 7000 ft., in exposed hot dry places, not as a rule in thick forests, in the basins of almost all the great rivers in the Panjab, Himalaya from the Jhelam to the Sutlej, and east of the latter. Not found on the Bias. Fl. Feb., March; the fruit ripens April, June.

Grows not nearly to such a size as the other species; the largest trunk noted by Dr Stewart, much above the average, measured 5½ ft. in girth. Twigs smooth, grey or reddish, bark of trunk brownish grey, not much marked by cracks or fissures. Wood used for ordinary domestic and agricultural purposes.

This species was discovered by Dr Stewart, and (doubtfully) identified by him, in Pb. Plants 30, with *A. creticum*, Linn., but subsequently recognised as a new species. It has no close affinity to any of the known species with 3-lobed leaves. The leaves are much larger than those of *A. monspessulanum*, L., or *creticum*, L., and are different in shape. Of the Japanese *A. trifidum*, Thunb., the leaves are much longer than broad. Without flowers, the affinity of the species cannot, however, be determined. It is not impossible that further inquiry may show this tree to be nearly allied to *A. Pseudoplatanus*, L.

4. **A. villosum**, Wall. Pl. As. rar. ii. 4.

Buds and young leaves covered with long silky hairs. Leaves cordate, 5-lobed, the 2 outer lobes small, irregularly and remotely dentate, on petioles exceeding half the length of leaf; basal nerves 5, the 3 inner penniveined. Flowers pentamerous, in lateral, more or less compound racemes, at the end of short lateral branchlets, appearing before the leaves. Peduncles and pedicels hairy; sepals oblong, with 3 nerves; petals linear, narrower than sepals; sepals and petals generally ciliate. Disc membranous. Stamens 8, in the male flowers much longer than calyx. Wings of fruit erect or divergent, back incurved; nuts large, the 2 nuts together forming a semicircle ½-¾ in. across.

Himalaya, at high elevations (7000-9000 ft.), not uncommon from the Jhelam to Kamaon. Chūr, Royle. Deoban range, D.B. Fl. Feb., March; leaves appear in May; fruit ripens from June onward. A large, handsome tree, smaller branches brown, striate, bark of stem grey and fairly smooth.

5. **A. cæsium**, Wall. (Herb. Kew).—**Tab. XXI.**—Vern. *Kīlu, trekhan, tarkhana, kīlpattar, tilpattar, mandar, mandari, mandarang, kauri, kalīndra, salīma, kanzal,* Pb.; *Kanshin,* Tibet (N.W.P.)

Buds glabrous, young leaves with a few scattered hairs. Leaves pale beneath, cordate, 5-lobed, the 2 outer lobes small, with 5 basal nerves, all, or the 3 inner penniveined, margin with large obtuse serratures, petioles exceeding half the length of leaf. Flowers pentamerous, appearing after the leaves, in terminal corymbose panicles. Nuts unevenly gibbous, wings erect or divergent, back slightly curved. (*A. sterculiaceum*, Wall. Pl. As. rar. t. 105, from Nepal, is similar, but the male flowers are represented in lateral racemes below the insertion of the leaves.)

North-West Himalaya, from the Indus to Nepal, between 4000 and 10,000 ft., scattered in mixed forests, mostly in shady valleys. Fl. Apr.; fruit ripens Oct.

A large tree, 70-80 ft., with a tall straight trunk 12-13 ft. in girth, and a large oval, close crown. Twigs laterally compressed, red or bluish, smooth, with some callous dots, bark of trunk dark ash-coloured, or pale-brownish white, with thin long irregular scales. Wood of pale cream-colour, with brown bands, porous, soft, light, medullary rays indistinct. Some of the inferior kinds of the Tibetan drinking-cups are made of it.

6. **A. caudatum**, Wall. Pl. As. rar. t. 132.—Vern. *Khānsing*, Nepal.

Young shoots pubescent. Leaves 5-lobed, the 2 outer lobes small; lobes long-acuminate; base truncate or subcordate, margin divided into deep sharp cuspidate serratures; basal nerves 5, the 3 inner penniveined. Petioles reddish, pubescent, longer than half the leaf. Flowers appearing soon after the leaves in lateral and terminal short glabrous racemes, frequently tetramerous. Sepals ovate-oblong, with 6 nerves. Petals white, clawed. Disc fleshy, stamens 4-6, in male flowers much longer than calyx. Racemes elongated in fruit; wings pink, erect, or divergent, inner edge frequently denticulate.

Himalaya, at high elevations (8000-11,000 ft.), from the Chenab to Nepal. Fl. March, April. A large-sized tree with dark-brown bark.

A. pectinatum, Wall., with divaricate wings, is probably only a variety. *A. argutum*, Maximowicz, from Japan, is nearly allied.

7. **A. pictum**, Thunb. Fl. Japon. 161.—Syn. *A. lætum*, C. A. Meyer; *A. cultratum*, Wall.; *A. Mono*, Maximowicz. Vern. *Kilpattar*, *trekhan*, *tarkhana*, *kakkru*, *kanzal*, *kānjar*, *jārīmu*, *laur*, Pb.; *Kanchli*, N.W.P.

Glabrous. Upper scales of buds oblong, clothed outside with adpressed hairs of a bright brownish yellow colour. Leaves broader than long, 5- or 7-lobed, from truncate or subcordate base; lobes long-acuminate, separated by rounded sinus, margin entire; basal nerves 5-7, the inner penniveined, with fine reticulation between. Petiole longer than leaf. Flowers appearing with or after the leaves on long filiform pedicels, in lateral and terminal stalked corymbs, pentamerous, glabrous; male and bisexual flowers on the same branch. Sepals oblong. Petals spathulate. Stamens 8, shorter than calyx. Disc fleshy, glabrous. Wings divaricate; back arcuate, somewhat recurved.

Outer and Middle Himalaya, from the Indus to Assam, between 4000 and 9000 ft. Outside India in Japan, North China, Mantchouria, the Caucasus, Armenia, North Persia. There is no difference between the Himalayan specimens and those from Western Asia; those from Japan have the wings less divaricate: but the shape and direction of the wings is not always a steady character in this genus. *A. Lobelii*, Tenore, from the higher mountains of South Italy, is closely allied; but Boissier, Fl. Orient. i. 949, considers it to be different from *A. lætum.*

The most common Maple in the N.W. Himalaya, usually found in mixed forests above 7000 ft. Leafless in winter. Leaves turn yellow and red in autumn before they are shed. Fl. about April, and the fruit ripens in summer. A large tree, 50 ft., with erect straight trunk 6-7 ft. girth, and wide-spreading branches. Bark dark brown, fairly smooth. Wood pinkish white, close-grained, fairly strong and elastic, not much valued for construction, but used for ploughs, bedsteads, and poles to carry loads. A large portion of the Tibetan drinking-cups are probably made of the knotty excrescences of this tree. The branches are lopped for fodder.

5. DODONÆA, Linn.

Shrubs, with alternate, simple, and entire leaves (pinnate in some of the Australian species), without stipules. Flowers unisexual and bisexual, often diœcious. Sepals 5 (sometimes fewer), valvate in the bud. Petals none. Disc small or inconspicuous. Stamens usually 8; filaments short; anthers basifixed, quadrangular, 2-celled, introrse, the cells opening longitudinally. Ovary 3- or 4-, rarely 5- or 6-celled, with 2 ovules in each cell. Capsule membranous or coriaceous, 2-5-celled, opening septicidally into as many valves as cells, each valve with a dorsal angle, often produced into a vertical wing. Seeds 1 or 2, with a thickened funicle, but not arillate; embryo spirally curled.

A large genus, of which about 45 species are known, with few exceptions endemic in Australia.

1. **D. viscosa**, Linn.; Boissier Fl. Orient. i. 953.—Syn. *D. Burmanniana*, DC.; W. & A. Prodr. 114; Wight Ill. t. 52; *D. angustifolia*, *D. dioica*, Roxb. Fl. Ind. ii. 256. Vern. *Sanatta*, *mendru*, *ban-mendu*, Pb.; *Banderu*, C.P.; *Bandurgi*, Can.

Leaves and young shoots more or less viscid with a bright yellow resin. Leaves varying from broadly oblong-lanceolate to linear-cuneate, gradually tapering into a marginate petiole, coriaceous, glabrous, shining, 1-4 in. long, acute obtuse or emarginate, entire or with shallow indentations, often revolute; one central nerve, with numerous parallel side-nerves, more or less distinct. Flowers in short terminal panicles or racemes. Sepals ovate, in the male flowers as long as stamens. Anthers oblong. Style generally longer than calyx, shortly 2-lobed at the top. Capsule membranous with 2, 3 or 4 membranous wings from base to style, including the wings ¾ in. across, and ½ in. long. Seeds opaque, dark brown or black.

Common in the lower hills of North-East Afghanistan, the Trans-Indus territory, Sindh, Beluchistan, and the Panjab. Ascends to 4500 ft. in the Himalaya. Also in Central and South India, Burma, and Ceylon. Gregarious, covers extensive tracts of country, often to the exclusion of other shrubs, in the Dekkan, in Mysore; here and there in North-West India. Outside India in Arabia, tropical Africa, tropical America, Florida, China, Java, Polynesia, and Australia. Fl. R. S. Fr. C. S.

A handsome evergreen shrub. In North-West India not more than 10 ft. high; on the mountains of Southern India a small tree 20 ft. high, with terete, compressed, or trigonous twigs. Wood light brown or bright yellow, hard, compact, and close-grained. Medullary rays indistinct. Annual rings fine, 26 on a specimen of 2¼ in. radius. The branches much used to support the earth of flat roofs, durable when thus employed. The shrub grows readily from seed without much water in arid places, and is planted in live hedges, for which it answers well.

6. STAPHYLEA, Linn.

Shrubs or small trees with opposite, stipulate, trifoliolate, or pinnate leaves. Leaflets with setaceous, deciduous stipels. Inflorescence definite, flowers bisexual. Calyx 5-parted, coloured, the segments imbricated in bud, 2 outside, 2 inside, 1 intermediate. Disc 5-lobed. Petals 5, alternate with the sepals, erect, imbricate in bud. Stamens 5, inserted below the edge of the disc, alternate with the petals; anthers oblong, versatile, fixed near the middle, 2-celled, introrse, the cells parallel, opening longitudinally. Ovary of 2 or 3 distinct carpels, more or less united by their inner angles; styles filiform, distinct or more or less coherent. Ovules 6-8 in each carpel, attached to the inner angle in 2 series. Fruit a membranous, usually vesicular inflated capsule, 3-celled, 3-lobed, dehiscent at the summit. Seeds few or solitary in each cell, testa thick and bony. Embryo straight, in the axis of a fleshy albumen; cotyledons oval or orbicular, flat and thin; radicle short.

1. **S. Emodi**, Wall.—Vern. *Mārchob* (Serpent-stick), Afg.; *Nāgdaun, chītra* (spotted), *chūal, ban-bakhru, bān-shāgali, gūldar, kāghania*, Pb.

Glabrous, young leaves with slight farinose pubescence beneath. Leaves trifoliolate; petioles round, glabrous, as long as, or longer than, the leaflets; leaflets nearly equal, ovate, acuminate, serrate, pale beneath, the terminal petiolulate, the lateral sessile. Stipules linear, membranous; stipels setaceous, both early deciduous. Flowers on short, compact, terminal, erect or drooping panicles, with numerous membranous, deciduous bracts. Petals as long as calyx-segments, both white. Stamens as long or a little longer; anther-cells attached to a linear, apiculate connective. Capsule 2-3 in. long, 1½ in. diam., yellowish white, narrowed at base, broad, tricuspidate at the top, hanging on pedicels ½-1 in. long. Seeds compressed, shining grey.

Trans-Indus on the Safed Koh. North-West Himalaya from the Indus to the Sarda, generally at elevations between 6000 and 7000 ft., descends to 2500 and ascends to 9000 ft. Usually scattered singly in mixed and coniferous forests, where it attains the size of a moderate tree. Fl. April, May; the fruit ripens from June-Aug., hanging like grey bells among the dark green foliage.

Twigs smooth, dark, or greenish grey, rugose and longitudinally striate, with large, oblong, white spots. Bark of stem spotted. Afghans and some tribes of the North-West Himalaya carry sticks of it, which are supposed to keep off snakes, probably because the spotted bark resembles a snake-skin.

There is but little difference between this species and the North American

S. trifolia, Linn., which is pubescent, and has anthers not overtopped by an apiculate connective. The Japanese species, *S. Bumalda*, DC., is also trifoliolate, but has lax, erect panicles, and small bifid capsules, of 2 carpels. *S. pinnata*, Linn., Central and South Europe, Western Asia, and *S. colchica*, Stevens, Caucasus, have imparipinnate leaves.

ORDER XXVIII. SABIACEÆ.

Shrubs or trees, with alternate leaves without stipules. Flowers small, unisexual or bisexual. Calyx 4-5-cleft, imbricate. Petals as many as sepals. Stamens hypogynous, as many as petals, and opposite to them. Anther-cells distinct, often adnate to a large and thick connective. Ovary 2-3-celled, styles distinct or connate. Ovules 1 or 2 in each cell. Fruit drupaceous, embryo without albumen or with very thin albumen.—Gen. Pl. i. 413; Royle Ill. 139; Wight Ill. i. 142 (*Millingtonieæ*).

Petals unequal; stamens 5, 2 fertile, 3 sterile . . .	1. MELIOSMA.
Petals equal; stamens 4-5, all fertile	2. SABIA.

1. MELIOSMA, Blume.

Trees or shrubs, with simple or pinnate leaves. Flowers in large terminal panicles, bisexual or unisexual. Sepals generally 5, somewhat unequal, imbricate. Petals 5, unequal, the 3 outer concave, orbicular, the 2 inner small, bifid. Stamens 5, opposite to petals, the 2 fertile adnate to the smaller petals, 3 sterile, without anthers, opposite to the larger petals; anther-cells of the fertile stamens globose, distinct, attached to a large flat connective. Ovary sessile, 2-3-celled, surrounded at the base by the cup-shaped, membranous, toothed disc; ovules 2 in each cell, superposed; style 1, straight subulate. Fruit a drupe, with a hard, generally 1-celled and 1-seeded kernel; seeds with membranous testa; cotyledons conduplicate; radicle incurved.

Flowers pedicellate in the axils of deciduous bracts; bracteoles none	1. *M. dilleniæfolia.*
Flowers sessile, 3-4 bracteoles under each flower . . .	2. *M. pungens.*

1. **M. dilleniæfolia**, Bl.—Syn. *Millingtonia dilleniæfolia*, Wall. Wight & Arnott in Edinb. New Philosoph. Journal, July 1833, p. 178. Vern. *Gwep*, N.W.P.

Young branches, petioles, and inflorescence covered with ferruginous pubescence. Leaves 6-12 in. long, obovate or elliptic, acuminate, pale beneath, with short adpressed hairs on both sides, and rusty pubescence along nerves and veins; midrib prominent, with 15-20 parallel lateral nerves on either side, the nerves terminating in short sharp serratures, with intermediate serratures between. Petioles ½-1 in. long. Panicle lax, pyramidal, branches at right angles, longer than uppermost leaves, rachis angular. Flowers bisexual, on short pedicels, in the axils of short deciduous bracts. Calyx not supported by bracteoles, of 5 imbricate, ciliate sepals, the 2 outside sepals smaller. The 2 petals attached to the fertile stamens bifid, shorter than the stamens.

Himalaya, Sutlej to Sikkim, between 4000-11,000 ft. Singly in shady mixed forests, a small tree, 20 ft. high and 2½-3 ft. girth, conspicuous by its large penniveined leaves. Small branches reddish brown, furrowed. Bark of stem whitish and corky. Fl. white, with deep yellow pollen, from May-July; the small fruit ripens from Aug. and onward. Wood reddish white, coarse-grained.

Nearly allied is *M. myriantha*, S. & Z., from Japan, the only apparent difference being more persistent bracts, and minute linear bractlets on the pedicel.

2. **M. pungens.**—Syn. *Millingtonia pungens*, Wall. Cat. 8114. D. F. Vern. *Gardar*, *kharas*, Kamaon.

Young branches, petioles, and inflorescence clothed with short rusty pubescence. Leaves coriaceous, pale beneath, pubescent when young, when full grown with rusty pubescence beneath along midrib and nerves, otherwise glabrous, 6-8 in. long, oblong or cuneate-lanceolate; lateral nerves arcuate, with prominent reticulate veins; petioles short, less than ½ in. long, edge with large, distant, mucronate serratures. Panicles rigid, pyramidal, compact, longer than uppermost leaves; branches at acute angles, branchlets at right angles. Flowers sessile, calyx of 5 ciliate sepals, supported by 1 or 2 imbricate bracteoles, resembling sepals. The 3 outer petals membranous, 3-5-nerved, not conform to sepals.

Himalaya, between 2500 and 8000 ft., from near the Indus to Nepal; rare west of the Sutlej. A small tree; fl. in May and June; the fruit ripens from July onward.

M. Wightii, Planchon, Hb. Kew (*M. pungens*, Bedd. Fl. Sylv. Manual, p. 77; *Millingtonia pungens*, Wall., according to Wight & Arnott, Prodr. 115; and Wight Ic. 964. 3), is probably the same species. It is a large tree of the Sholas on the Nilgiris and other mountains near the western coast, above 5000 ft., and of Ceylon, with hard, coriaceous, entire or distantly-toothed lanceolate leaves; flowers hirsute, sepals and outer petals conform, thick, with fleshy base.

Another species nearly allied to these is *M. simplicifolia*, Blume (*Millingtonia simplicifolia*, Roxb. Fl. Ind. i. 103; W. & A. Prodr. 115; Griff. Pl. As. tab. 442). Eastern India, as far as Nepal, and perhaps further west; Southern India and Ceylon. A large tree, with obovate or oblanceolate leaves, entire or serrate in young plants, minute, nearly sessile yellow flowers, glabrous petals, hirsute sepals, and a bract conform with sepals. This again is similar to *M. angulata*, Bl., a tree from Java.

2. SABIA, Colebr.

Scandent or sarmentose shrubs with simple entire leaves. Flowers bisexual. Sepals 4-5, equal. Petals 4-5, equal, opposite to sepals, imbricate. Disc annular, 5-lobed. Stamens 4-5, all fertile, inserted on the disc; filaments thick. Ovary 2-lobed, the lobes cohering with the axis; styles 2, erect, terminal, more or less cohering; 2 ovules in each lobe. Fruit of 1 or 2 drupaceous or dry carpels; endocarp hard, rugose. Seeds 1 or 2 in each carpel, embryo curved.

Flowers axillary, solitary or in few-flowered fascicles . . 1. *S. campanulata.*
Flowers in large, terminal, and axillary panicles . . 2. *S. paniculata.*

1. **S. campanulata**, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 311.

A glabrous climbing shrub, branches woody. Leaves membranous, pale beneath, oblong-lanceolate, 3-4 in. long, decurrent into a ciliate petiole. Peduncles axillary, 1-flowered, 1-2 in. long, mostly solitary. Flowers green, large. Calyx minute, with 5 spreading obtuse lobes. Petals membranous, $\frac{1}{3}$-$\frac{1}{2}$ in. long, ovate, concave, obtuse, parallel-veined. Drupes twin, nearly distinct, obliquely obovate or reniform, flat, rugose, $\frac{1}{4}$ in. diam.

Himalaya, Kashmir, Sikkim, 5000-10,000 ft. elev. Fl. April, May, when the stem is nearly naked, and the buds begin to bring forth their young leaves.

2. **S. paniculata,** Edgew. MSS. in Herb. Kew.

A glabrous climbing shrub, leaves coriaceous, oblong-lanceolate, acuminate, 5-8 in. long. Flowers small, in terminal and axillary panicles; pedicels and calyx hairy. Petals lanceolate, $\frac{1}{12}$ in. long, or less. Drupes generally solitary, circular, compressed, $\frac{1}{3}$ in. diam.

Sub-Himalayan tract, Dehra Doon to Nepal, ascending to 3000 ft. Fl. spring.

ORDER XXIX. **ANACARDIACEÆ.**

Trees or shrubs, with alternate, rarely opposite, simple trifoliolate or imparipinnate leaves, without stipules. Flowers mostly regular, unisexual or bisexual. Calyx 3-7-, commonly 4-5-cleft. Petals as many as calyx-lobes. Disc generally annular. Stamens as many as petals or more, often twice as many, generally inserted outside at the base of the disc, all or a portion only perfect; anthers 2-celled, dehiscing lengthwise. Ovary various, either 1-celled with 1 ovule and 3-4 styles, or a trifid style (probably the result of an unequal development of 3 carpels), or 1-celled, with a simple oblique style (apocarpous, the other carpels abortive), or 5-6 distinct ovaries, but 1 only fertile; or lastly (tribe *Spondieæ*), 2-5-celled, 2-5-seeded. Fruit generally drupaceous, mostly 1-celled, 1-seeded, rarely 2-5-celled, 2-5-seeded. Albumen none.—Gen. Pl. i. 415; Royle Ill. 174; Wight Ill. i. 180 (*Terebinthaceæ*).

Fruit 1-celled, 1-seeded.	
One 1-celled ovary, with a trifid style, or 3-4 distinct styles.	
Ovule suspended from a funicle attached near the base of ovary.	
Petals 4-6, ...	1. RHUS.
Petals none	2. PISTACIA.
Ovule suspended from near the top of ovary.	
Stamens 8-10; leaves imparipinnate	3. ODINA.
Stamens 5; leaves simple	4. SEMECARPUS.
One 1-celled ovary, with a simple lateral style	5. MANGIFERA.
Carpels 5-6, distinct, 1 only fertile	6. BUCHANANIA.
Fruit 2-5-celled, 2-5-seeded	7. SPONDIAS.

1. **RHUS,** Linn.

Trees or shrubs, with a resinous, sometimes viscous milky, often caustic juice. Leaves alternate, pinnate with a terminal leaflet, or trifoliolate, rarely simple, without stipules. Flowers small, white or greenish, generally diœcious, in axillary or terminal panicles. Calyx of 5 sepals, united at the base, equal, imbricate, 2 outside, 2 inside, 1 intermediate. Petals 5, deciduous, alternate with the sepals, equal, inserted on the base of the calyx outside the disc. Disc fleshy, coherent with base of calyx, annular or 5-lobed, the lobes opposite the petals. Stamens 5, alternate with the petals, inserted on or under the edge of the disc; anthers 2-celled, introrse, the cells opening longitudinally, in the fertile flowers smaller and more or less imperfect. Ovary in the fertile flowers ovoid or globular, sessile, 1-celled; styles 3, short; ovule solitary, anatropous, suspended from a long filiform funicle, which rises from the base of the cell. Fruit a small dry drupe; endocarp bony or crustaceous; albumen none, cotyledons flat, radicle incurved, generally superior.

Leaves simple	1. *R. Cotinus.*
Leaves trifoliolate.	
Unarmed, terminal leaflet 2-3 in. long	2. *R. parviflora.*
Spinescent, terminal leaflet 1-1½ in. long	3. *R. mysorensis.*
Leaves imparipinnate; panicle terminal; fruit hairy.	
Leaflets dentate; petiole marginate	4. *R. semialata.*
Leaflets entire or subserrate, petiole not marginate	5. *R. punjabica.*
Leaves imparipinnate; panicles numerous, lateral, ripe fruit glabrous.	
Tomentose; pericarp splitting when ripe	6. *R. vernicifera.*
Glabrous; pericarp not splitting when ripe	7. *R. succedanea.*

1. **R. Cotinus**, L.*—Syn. *R. velutina*, Wall. Vern. *Pāan*, *bhān*, *manu*, *banthra*, *tūng*, *tittri*, Pb.; *Tūnga*, *tungla*, *tung*, *chaniāt*, *āmi* (from *ām*, Mango), N.W.P.

Branchlets, petioles, and under side of leaves covered with short soft pubescence. Leaves elliptic or obovate, entire, obtuse, on long petioles, often longer than leaves, lateral nerves 10-15 pair, parallel, straight below, arcuate above. Flowers on slender pedicels, in a lax panicle, ramifications and pedicels pilose, bracts subulate. Fertile flowers few. Drupe compressed, semicordate or obliquely obovate, 1-seeded, about ¼ in. long, covered with short white hairs while young, glabrous and rugose with prominent veins when ripe. Pedicels of the sterile flowers elongated after flowering, and densely covered with long silky hairs, forming a spreading panicle of slender feathery branches.

Eastern slopes of Suliman range and N.W. Himalaya to the Sarda river, between 2300 and 6000 ft. Outside India in South Europe, West Asia, Caucasus. A shrub or small tree, to 20 ft. high, and 3 ft. girth, growing somewhat gregarious, mostly on arid, sunny slopes, often forming an underwood in forests of *Pinus longifolia* with *Berberis*, *Andromeda*, and other shrubs. Leafless for a short time, the young reddish leaves come out in April. Fl. Apr.-Sept.; fr. autumn. The South European shrub is hardy in England.

Bark of trunk and larger branches dark grey or brown, with white dots, and often with horizontal yellowish bands, smooth, hard, peeling off in flakes. The leaves and flowers when bruised emit a pleasant balsamic odour, supposed to resemble the smell of Mangoes, hence one of the vern. names. Wood yellowish, hard, strong, close- and even-grained, often beautifully mottled, used for inlaid and cabinet work in South Europe. In the Himalaya the twigs are used for basket-work, and the small branches as tooth-sticks. Bark and leaves used for tanning.

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* I have seen a good deal of *R. Cotinus* in South Europe, and of *R. velutina* in the Himalaya, and do not hesitate to unite them, though the former is glabrous.

2. **R. parviflora**, Roxb. Fl. Ind. ii. 100.—Vern. *Tūnga, tūngla, dungla, rāi tūng, tumra, rannel,* N.W.P.

An unarmed shrub. Younger branches, petioles, and the under side of leaves clothed with dense brown tomentum. Leaves trifoliolate, leaflets oblong-obovate, the lower part entire, the upper part irregularly crenate. Lateral leaflets sessile, smaller, the terminal larger, 2-3 in. long, narrowed into a short marginate petiole; lateral nerves 10-15 on either side of midrib, with shorter intermediate ones. Panicle large, compound, terminal, lower branches from the axils of leaves, with short, erect, corymbose branchlets; pedicels shorter than flowers, bracts linear. Ramifications of panicle and bracts with long white silky hairs. Sepals ovate, the outer hairy, 2 somewhat narrower than the rest. Petals oblong, more than twice the length of sepals; disc distinctly 5-lobed, lobes opposite to petals. Drupes ovoid, ⅛ in. across, glabrous, brown, shining.

Common N.W. Himalaya, between 2000 and 5000 ft., from the Sutlej to Nepal, on the Pachmarhi hills, Central Provinces, and in Ceylon. Often gregarious on bare arid slopes. Fl. May-June; fr. July, Aug.

Bark grey, smoothish, longitudinally rugose. Wood yellowish, close-grained, and hard. Mixed with salt, the fruit is used like Tamarind (Benar valley, Bhawar). The *tantarīk* of the Panjab bazaars, which is used in Hindu medicine (generally attributed to *Pistacia Terebinthus* and *Lentiscus*), is partly at least the fruit of this tree.

3. **R. mysorensis**, Heyne; W. & A. Prodr. 172.

A small shrub, branches stiff, often spinescent; branchlets with short grey or brown tomentum. Leaves trifoliolate, leaflets obovate or cuneate, with scattered short hairs above, and with soft grey or brown pubescence beneath, deeply dentate or lobed, the 2 lateral leaflets sessile, smaller, the terminal 1-1½ in. long, sessile or narrowed into a short marginate petiolule. Panicles terminal, compound, pubescent, the lower branches from the axils of leaves, with short racemose branchlets; bracts minute, linear, pedicels shorter than flowers. Sepals ovate, 2 smaller than the rest. Petals oblong, more than twice the length of sepals. Disc indistinctly 5-lobed. Drupes glabrous, brown, shining.

Eastern flank of Suliman range 2500-5000 ft., hills west of Sindh below 4000 ft. near Delhi, the Dekkan, and South India. Fl. Feb.; fr. April.

Gregarious in arid hot places; the leaves when bruised have a balsamic smell; the wood is used for fuel. Possibly not distinct from *R. parviflora,* Roxb.

4. **R. semialata**, Murray; D.C. Prodr. ii. 67.—Syn. *R. javanica,* Linn.; *R. Bucki-amela,* Roxb. Fl. Ind. ii. 99; Wight Ic. t. 561. Vern. *Tatri, thīssa, tetar, tītri, chechar, arkol, arkhar, kakkri, kakkeran, phus-kakrein, dūdla, lrāsh, wānsh, hulāshing, kāshīn,* Pb.; *Dakhmūla, daswūla,* N.W.P.; *Bakkiamela,* Nepal.

A moderate-sized tree. Young branches, petioles, and inflorescence covered with short, soft, dark-grey pubescence. Leaves imparipinnate, 12-18 in. long; upper part of petiole generally marginate; leaflets opposite, 4-6 pair, sessile (the terminal leaflet on a marginate petiolule), oblong or elliptic from an oblique base, acuminate, with large triangular, often sharp teeth, 10-15 main lateral nerves on either side of midrib, glabrous or pubescent with scattered hairs above, and clothed with dense, grey or brown tomentum beneath. Panicle terminal, large, nearly as long as the upper leaves; branches spreading. Flowers small, pale yellowish green. Drupe globose or obovoid, nearly ¼ in. across, greenish yellow, or dark reddish brown, covered with short tomentum. Kernel compressed, smooth, brown, with a hard shell.

Common in the outer Himalaya between 2500 and 6000 ft., at times attaining 7000 ft., from the Indus to Assam. Kasia hills. Beyond India, in China and Japan. Deciduous; leaves get red before they fall; the flowers appear at various times between spring and autumn, chiefly April-June; the fruit ripens Aug.-Oct. In Japan fl. in Sept. (Thunberg, Flora Japonica, 121).

35-40 ft. high, with a short erect trunk 3-4 ft. girth, few ascending branches forming an oval head. Galls of various shapes, often stalked, frequent on the branches, in Japan and the N.W. Himalaya, an article of trade in Japan and China. Wood greyish white, soft, light, and not valued. Pulp of fruit acid, eaten in Sikkim and Nepal, and used medicinally.

5. **R. punjabensis**, J. L. Stewart.—Vern. *Tītari*, *tetar*, *arkhar*, *palāi*, *choklu*, *kangar*, *kakkrein*, *dor*, Pb.

Young branches and petioles covered with short grey pubescence. Leaves imparipinnate, 12-15 in. long; leaflets opposite, 5 or 6 pair, nearly sessile, the terminal petiolulate, ovate-oblong, from a rounded oblique base, acuminate, entire, occasionally serrate near apex, pubescent beneath, particularly along nerves, short scattered hairs above; 10-15 main lateral arcuate nerves on either side of midrib, with a few intermediate shorter nerves. Panicle terminal, compact, pyramidal, less than half the length of leaf, ramifications with rusty pubescence. Drupes on short pedicels, subglobose, small, ⅛ in. diam. Pericarp crustaceous, clothed with a dense purplish tomentum; kernel compressed, unequal-sided, broader than long, grey, shining.

Rajaori, Bussahir (Serahn), and elsewhere in the N.W. Himalaya, between 2500 and 8500 ft. Mostly in mixed forests, in places not too arid. Fr. Aug., Sept. A fair-sized tree, 35 ft. high and 4 ft. girth, with a broadish-oval crown, resembling *R. succedanea* in size, general appearance, and its corrosive juice. Nearly allied to *R. sylvestris*, Sieb. & Zucc., of Japan.

Another species, with terminal flower-panicles and imparipinnate leaves, is *R. Coriaria*, L., Boissier Fl. Orient. ii. 4, of South Europe, Algeria, and Western Asia; found in Persia, but not yet discovered in N.W. India. The leaves, dried and pounded, form an important article of trade under the name of *Sumach*, used for tanning the finer kinds of leather. Dye-stuff (for morocco leather) is made of the bark. The fruit is acid, and is eaten.

6. **R. vernicifera**, DC., Prodr. ii. 68.—Syn. *R. vernix*, Linn. (partly); *R. juglandifolia*, Wall. (not Willd.) Vern. *Kambal*, *gadūmbal*, *rīkhali*, *rūkhro*, *arkhar*, *arkol*, *harkū*, *lohāsa*, Pb.; *Akoria*, *kaunki*, (*gur*) *bhaliūn*, N.W.P.; *Bhalāio*, *chosi*, Nepal.

A tree. Young branches, petioles, under side of leaves, and inflorescence clothed with dense, soft, rusty or greyish-brown tomentum; leaves approximate near ends of branches, 12-15 in. long, imparipinnate; leaflets opposite, 3-5 pair, nearly sessile, the terminal long-petiolulate, oblong or elliptic from unequal-sided base, acuminate, entire, with 20-25 arcuate main nerves on either side of midrib. Panicles much shorter than leaves, lateral from the axils of the lower or of fallen leaves. Flowers nearly sessile, petals with dark veins. Fruit ovoid or globose, $\frac{1}{3}$ in. long, in compact pyramidal panicles, rusty pilose when young, nearly glabrous when ripe. Outer pericarp dry, chartaceous, splitting irregularly. Kernel hard, smooth, in a mass of vegetable wax.

Common in places between 2000 and 4000 ft., ascending to 7000 ft., Himalaya from the Indus to Sikkim. Fl. May, June; fr. July-Sept. A large handsome tree, 50 ft., with a trunk attaining 5-6 ft. girth. Mostly in open places, not in forests. Bark of trunk grey, smooth, shining. Wood reddish brown, with indistinct medullary rays, soft, not valued. (On the Sutlej, yellow when dry; used for saw-frames and axe-handles.) The milky juice of the leaves is corrosive. It blisters the skin dreadfully. In Jaonsar Bawar it is rubbed on thread, to strengthen it.

I follow Decandolle and Royle (Ill. 175) in uniting the Indian tree with the Varnish-tree of Japan (*R. Vernix*, Linn.; Thunberg Fl. Japon, 121). I do so, however, with great reluctance; for I feel assured that they are not the same species. Wallich's name, *R. juglandifolia*, had unfortunately been anticipated by Willdenow for a species from New Granada. I have therefore no alternative, as it does not appear to me expedient to found a new name on the materials at present available to me. The leaves of the Japanese specimens are less tomentose, and the flowers are pedicellate, in lax panicles, longer than half the length of leaf. I have not seen specimens from Japan in fruit, but Gärtner's and Kämpfer's description seems to show that the pericarp does not split as it does in the Indian tree. Nor is the Himalayan tree known to yield any varnish. Gärtner (Fruct. i. p. 205, t. 44) describes the fruit of the Japanese tree as "drupa exsucca, turgide lenticularis, rotundo-rhomboidea: vertice acuminato, obliquo, excentrico. Cortex (the pericarp) crassus, fibroso-fungosus, superficie lævigatissima, splendente, spadiceo-lutea." Kæmpfer Amœnitates exoticæ (1712), p. 791, describes the tree under the Japanese name *Sitz-dsju* and *Urus-no-ki*, and says, "Fructus facie ac magnitudine ciceris, membranula tenui micante vestitus, per maturitatem durissimus et obsoleti coloris."

In Japan the Varnish-tree appears to be cultivated as coppice-wood. Kämpfer states that the varnish is obtained by incisions in stems three years old, these are cut down when exhausted, and the tree shoots up again. In Kämpfer's time the varnish obtained from this tree was considered superior to the varnish from China and Siam (*Melanorhœa usitatissima?*), and was often mixed with the inferior kinds. Candles are made in Japan of the wax round the fruit.

7. **R. succedanea**, L.; Roxb. Fl. Ind. ii. 98; Wight Ic. t. 560.—Syn. *R. acuminata*, DC. Prodr. ii. 268. Vern. *Tatri, arkol, arkhar, titar(i), lakhar, rīkhūl*, Pb.; *Shash*, Kunawar; *Fási-no-ki*, Japan. (Kæmpfer, Amœn. exoticæ, p. 794.)

Glabrous. Leaves approximate at the ends of branches, 6-12 in. long, imparipinnate; petiole round, naked; leaflets opposite, 3-6 pair, 2-4 in. long, petiolulate from unequal base, oblong-lanceolate, entire, long-acuminate; lateral nerves 10-15 on either side of midrib. Panicles numerous, lateral, much shorter than leaves, in the axils of the lowest leaves or below them from the axils of the bud-scales. Flowers small, greenish yellow; pedicels nearly as long as flowers. Drupes on lax drooping panicles, oblique, compressed, outline rhomboid, about ⅓ in. long, glabrous, rugose, yellow or light brown; kernel smooth, whitish, hard, enclosed by a fibrous pericarp; vegetable wax mixed with the fibres. Seeds large, oily.

In many parts of the Himalaya from 2000-8000 ft., from the Jhelam to Assam. Usually in mixed forests. (Nachar forest, Bassahir.) Kasia hills; also in China and Japan. Deciduous. Leaves fall in October, and turn red before they fall. Fr. Aug., Sept. A moderate-sized tree, 30 ft. high, with a short trunk 3 ft. girth. The milky juice of the tree causes blisters and makes black stains on paper. In Japan (Kæmpfer, l. c.) the seed (and pericarp ?) is crushed, boiled, mixed with the fruit of another tree (*Sindan*, *Melia Azedarach ?*), and pressed, while hot. The result is a beautiful vegetable wax of snow-white colour, of which candles are made. Kämpfer calls this the wild Varnish-tree, and states that it yields a small supply of varnish.

2. PISTACIA, Linn.

Trees or shrubs, with alternate, pinnate, or trifoliolate leaves without stipules, and small unisexual diœcious flowers without petals in axillary racemes or panicles. Male flowers with a 3-5-cleft calyx, and 3-6 stamens, on a small disc. Female flowers supported by bracts. Sepals 3-4. Ovary sessile, 1-celled, style short, 3-fid; stigmas 3 capitate, recurved; ovule 1, suspended from a basifixed funicle. Fruit a dry drupe, with a hard, bony kernel. Seed with a membranous testa, a curved embryo and thick plano-convex, often green cotyledons, filled with fat oil.

1. **P. integerrima**, J. L. S.—**Tab. XXII.**—Syn. *Rhus integerrima*, Wall.; *R. kakrasingee*, Royle. Often erroneously called *R. acuminata.* Vern. *Shuē*, *sarawān*, *masua*, Afg.; *Kakkar*, *kaṅgar*, *kākra*, *kākla*, *kākāi*, *kakkraṅgche*, *tūngu*, *gūrgu*, Pb., N.W.P.

A tree, nearly glabrous. Leaves impari- or pari-pinnate, 6-9 in. long, with fine pubescence along petioles and nerves while young; leaflets opposite or nearly so, 4-5 pair; short-petiolulate, lanceolate from oblique base, entire, long-acuminate, with 10-18 arcuate lateral nerves, joined by reticulate veins. Flowers on lateral panicles, the leaves below on the previous year's wood. Male panicles short, compact, pubescent. Stamens 5, 6, or 7; anthers large, oblong, obtuse, deep red. Sepals much shorter than stamens. Female flowers on short pedicels, in long lax panicles. Calyx of 4 linear sepals, generally supported by 2 ovate bracts, shorter than sepals. Sepals and bracts deciduous. Style 3-fid nearly to the base, with broad recurved stigmas. Drupe dry, somewhat broader than long, ¼ in. broad, rugose, glabrous, grey when ripe.

Eastern slopes of the Suliman range, hills of Trans-Indus territory, and round the Peshawar valley, between 1200 and 4000 ft. Salt range, and many parts of the Siwalik tract and the outer Himalaya, between 1500 and 6500 ft., ascending at times to 8000 ft. from the Indus to the Sarda. Often scattered on hot bare rocky slopes. Cultivated in gardens of the Panjab plains. The dark-green leaves fall in February, the young foliage appears about March, together with the red flower-panicles, giving the tree a striking appearance for some time. At 4000-5000 ft. elevation the flowers open in May, and the fruit ripens from June-October.

A shady tree, 40 ft. high or more ; trunk attaining a girth of 8-9, and at times 12-15 ft. Twigs ash-coloured or reddish brown, longitudinally rugose, with white specks ; bark of trunk grey. The heartwood of mature trees is the best and most handsome wood of the North-West Himalaya for carving, furniture, and all kinds of ornamental work. It is hard, close- and even-grained, brown, beautifully mottled with yellow and dark veins, and takes a fine polish. The sapwood is liable to be attacked by insects ; but the heartwood is durable, highly prized, and consequently often cut recklessly. In Kangra, under native rule, it was one of the Padshāhi or Royal trees.

The tree is lopped severely, the twigs and leaves being a favourite food of buffaloes and camels. Gall-like excrescences, black, hard, rugose, hollow, irregularly crooked, often 6-7 in. long, are formed in October on leaves and petioles. They are sold under the name of *Kakra-singi*, and are used in native medicine. The fruit of this tree is probably the Sumāk of the Panjab bazaars, used to strengthen digestion.

Two other trees of the same genus grow in Beluchistan and Afghanistan, and yield a resin similar to mastich, called in Sindh *Sahti kūndru.* They also yield galls of various shape and colour. One of these, *P. Khinjuk*, J. E. Stocks ; Boissier Fl. Orient. ii. 6, called *Khinjak*, *Khanjak*, *Sharamna*, *Sheawna*, *gewāun*, in Afghanistan and Beluchistan, with unwinged petioles, is nearly allied to *Pistacia Terebinthus*, L., a shrub or small tree of South Europe and Western Asia, which yields the Chios or Cyprus turpentine. The other (*Kasūr*), with winged petioles, *P. cabulica*, J. E. Stocks, Boissier l. c., is allied to *P. atlantica*, Desf., a large tree 60 ft. high, of North Africa, Mount Atlas, and the Canary islands, which furnishes a resin similar to mastich. The true mastich of Chios, which is used all over the Levant for fumigation, and which is chewed to whiten the teeth, and to make the breath agreeable, is the product of *P. Lentiscus*, Linn., an evergreen shrub, with paripinnate leaves, of the Mediterranean region. The pistachio-nuts, which are imported into India from Afghanistan, are produced by *Pistacia vera*, Linn., a small tree with 3-5 broad-ovate leaflets, of Syria, Mesopotamia, Persia, which is cultivated in Sicily, and other parts of Southern Europe.

3. ODINA, Roxb.

Trees with deciduous, alternate, imparipinnate leaves ; leaflets opposite, entire. Flowers small, unisexual, fasciculate, in racemose panicles. Calyx 4-5-cleft, persistent, lobes imbricate in bud. Petals as many as calyx-lobes, imbricate in bud. Male flowers : an annular crenate disc, bearing stamens double the number of petals, surrounding a 4-cleft rudiment of ovary ; anthers versatile, attached above the base. Female flowers : short sterile stamens on disc, surrounding the ovary. Ovary ovoid, 1-celled, with 4 distinct, short thick styles, and a solitary pendulous ovule. Fruit a drupe, with a hard kernel ; embryo with flat fleshy cotyledons.

1. **O. Wodier**, Roxb. Fl. Ind. ii. 293 ; W. & A. Prodr. 171 ; Wight Ic. t. 60 ; Bedd. Fl. Sylv. t. 123.—Vern. *Kiāmil*, *kembal*, *kimlu*, *kamlāi*, *koāmla*, *batrīn*, *dila*, *dhauntika*, *sulāmba*, *pīchka*, *līdhra*, Pb. ; *Jhinghan*, *jiban*, *sindan*, *kanni*, *karallu*, N.W.P. ; *Jhigna*, *Jhingan*, Oudh ; *Ganjak*,

moian, *moyen*, *mowi*, *barna*, *dampara*, C.P.; *Moina*, Guzerat; *Wodier* and *Wude* in Tamil (hence the specific name); *Gharri-marra*, Gonds, Satpura range. *Nabhay*, Burm.

Young branches, leaves, and inflorescence with deciduous stellate tomentum. Leaves few, near ends of branches, 12-18 in. long, more or less glabrous when old, leaflets 3 or 4 pair, short-petiolulate, ovate, the terminal long-petiolulate. Flowers tetramerous, on short pedicels in compact, few-flowered cymose fascicles, the female flowers in simple, the male flowers in compound racemes. Racemes numerous at the end of branches, or on short lateral branchlets, male and female on different branches (often on different trees). Bracts numerous, broad-ovate, ciliate. Calyx-lobes obtuse, ciliate. Petals oblong, more than twice the length of calyx, coriaceous, spreading, purplish and greenish-yellow. Stamens 8, in male flowers as long as petals. Drupe on short pedicel, obliquely oblong, compressed, ½-⅔ in. long; epicarp coriaceous, glabrous, red when ripe. (Sometimes black?)

Common in dry forests in most parts of India and Burma, extending north-west to the Indus, and ascending to 4000 ft. in the outer Himalaya. Leafless from January or February to June; the flowers appear before the leaves between February and April; the fruit ripens from June onward, and often remains long on the tree.

A large tree, 40-50 ft. high, with an erect trunk, attaining generally 5-6 ft. in girth (12 ft. Baraich and Gonda forests, Oudh). Branches not numerous, large, spreading. A handsome tree when in full foliage, an eyesore when leafless. Bark 1 in. thick, ash-coloured, brown, or blackish, smooth, with scaly plates exfoliating, inner substance reddish, mucilaginous. Sapwood whitish, large, often nearly half the radius. Heartwood dull red, or reddish brown. A cub. ft. weighs 50-60 lb., P. 821. Works and planes smooth, polishes well, and, save that it is heavy, might be valuable for cabinet-work. Used for spear-shafts, scabbards, spokes of wheels, and (in Burma) for oil-presses and rice-pounders.

A yellowish-white gum exudes in spring, which is largely collected, and used in cloth-printing by weavers, and in medicine. The tree is often lopped and pollarded, the leaves and branches being a favourite fodder of cattle. Elephants are very fond of the young shoots.

4. SEMECARPUS, Linn. fil.

Trees with alternate, petiolate, simple, coriaceous leaves, and small polygamous flowers in lateral or terminal panicles. Calyx 5-cleft, the segments deciduous. Petals 5, imbricate. A broad annular disc between stamens and ovary. Stamens 5, small and sterile in the female flowers. Ovary 1, 1-celled, with 3 styles; ovule solitary, pendulous. Fruit an oblong, more or less oblique drupe, with a thick pericarp, its cells filled with an acrid resinous juice, surrounded at the base by a fleshy cupular or turbinate hypocarp, formed of the thickened receptacle and base of calyx.

1. **S. Anacardium**, L.; Roxb. Cor. Pl. t. 12; Fl. Ind. ii. 83; W. & A. Prodr. 168; Wight Ic. t. 558; Bedd. Fl. Sylv. t. 166.—*The Marking Nut tree.*—Sans. *Arushkara*, *bhallātaka*. Vern. *Bhilāwa*, *bhaliau*, Pb.,

N.W.P.; *Bhāla*, Oudh; *Koka*, *bhallia*, C.P.; *Kohoka-marrah*, Gonds, Satpura Range.

Young branches, inflorescence, petioles, and under side of leaves clothed with a short, somewhat harsh, tomentum of simple hairs. Leaves approximate near extremities of branches, oblong-obovate, 9-18 in. long, rounded at the top, with rounded or cordate base, on a short, thick, half-round petiole. Flowers nearly sessile, fasciculate, the fascicles arranged in erect compound terminal panicles. Bracts lanceolate, the lower branches of panicle in the axils of leaves. Petals oblong, 3-4 times the length of calyx, spreading, glabrous, greenish yellow. Filaments subulate from a somewhat dilated base. Drupe obliquely oval or oblong, about 1 in. long, smooth, shining, purplish black when ripe, hypocarp orange.

Locally abundant in most parts of India, its north-western limit somewhat beyond the Sutlej river; ascends in the outer Himalaya to 3500 ft. Deciduous, old leaves shed in February, new foliage issues in May. The flowers appear at various times, generally soon after the leaves; the fruit ripens from November to February. A moderate-sized tree, attaining 30 ft. (but often smaller), with an erect trunk 4 ft. girth. Bark 1 in. thick, dusky grey, blackish, with irregularly quadrangular plates, separated by narrow longitudinal and shallow irregular cross furrows or wrinkles, in old trees rough with exfoliating scales. Inner surface of bark red, exuding a juice which blackens on exposure. Wood ash-coloured, reddish white, or brown, even- but open-grained, weight 42 lb. per cub. ft. Sap- and heart-wood not distinct. The wood is full of an acrid juice, which causes swelling and irritation; timber-cutters object to felling it unless it has been ringed for some time. Cracks in seasoning, is not durable, and is not much used. Bark adstringent, used in dyeing.

A brown, nearly insipid gum exudes from the stem. The leaves serve as plates. The ripe fruit is collected: the hypocarp is eaten; fresh, it is acrid and adstringent—roasted, it is said to taste somewhat like roasted apples, and when dry somewhat like dates. The pericarp is full of acrid juice, which is used in native medicine. A black varnish is prepared from it, and mixed with lime-water it is used for marking cotton. The oil of the seeds, mixed with the milk of *Euphorbia*, is made into birdlime by the wild tribes of the Satpura range in the Central Provinces.

5. MANGIFERA, Linn.

Trees with alternate, petiolate, simple, entire, coriaceous leaves. Flowers polygamous, in terminal panicles. Calyx 4-5-parted, imbricate, deciduous. Petals equal number, imbricate with prominent thick longitudinal nerves. Stamens 4-5, inserted on a more or less prominent disc; 1 stamen only perfect, much larger than the others. Ovary sessile, 1-celled, oblique, with a lateral simple style and 1 ovule, attached to the side of the cell above its base. Fruit a large fleshy drupe, with a fibrous kernel, 1-seeded. Testa thin, chartaceous, no albumen; cotyledons fleshy, plano-convex, often unequal and lobed; radicle inferior.

1. **M. indica**, L.; Roxb. Fl. Ind. i. 641; W. & A. Prodr. 169; Bedd. Fl. Sylv. t. 162. The *Mango-tree.* Sans. *Amra*,; Malay, *Manga.*—Vern. *Am*, *āmbi*, *āmri.* Local name, *Marka-marrah*, Gonds of Satpura range. *Thayetben*, Burm.

A large evergreen tree, glabrous; leaves generally 6-12 in. long, dark green, coriaceous, approximate near the extremities of branches, oblong-lanceolate, entire, the margins often waved; petioles swollen at base; numerous arcuate lateral nerves, with shorter intermediate nerves. Panicles large, erect, a little downy, with horizontal branches, and oval somewhat concave bracts. Flowers pale yellow, strongly scented, male and bisexual flowers on the same panicle. Sepals 5, oblong, concave. Petals ovate, twice the length of sepals, with dark yellow or orange lines near the base. Disc fleshy, 5-lobed, surrounding the ovary, and connate with its base; the stamens inserted between it and the ovary. Filament 1, subulate, bearing an oval purple anther; sterile stamens 2-4, minute. Ovary obliquely ovoid, with a lateral incurved style. The fruit varies in length from 2-6 in., is compressed, generally yellow when ripe, with a more or less flattened fibrous kernel, the radicle generally bent upwards.

The Mango-tree, or wild forms which are closely allied to the cultivated kinds, is indigenous in Burma, along the Ghats of the western coast (extending northwards to Khandeish), in the Kasia hills, Sikkim, and in ravines of the higher hills of the Satpura range. It is also believed to be wild in the sub-Himalayan tract, in deep gorges of the Baraitch and Gonda hills in Oudh, and of the outer hills in Kamaon and Garhwal. Roxburgh, l. c. 644, describes the wild Mango of Silhet as *M. sylvatica*, with linear petals many times longer than calyx, and a short, turbinate, slightly grooved disc. The Mango is cultivated throughout India, but west of the Ravi it almost disappears, except at a few places in Mozaffargarh, and about Seālkōt. At Peshawar there are only a few small trees with indifferent fruit, and it is very scarce further down in the Trans-Indus territory. In Upper Sindh (near Sukkhur), the Mango is grown in gardens and produces good fruit, but requires to be protected against frost while young. In the outer N.W. Himalaya it is cultivated as high as 3500 ft. In India, the Malayan Peninsula, and the Indian Archipelago, the Mango-tree has been cultivated from time immemorial. It is also cultivated in other tropical countries, particularly in Brazil and the West Indies, but its introduction into America is of comparatively recent date (1782 to Jamaica). The young foliage is purplish green, and comes out between Feb. and June. Fl. between Feb. and April, according to latitude, elevation, and locality; the fruit ripens between May and July.

Attains 60-70 ft. in North India; trunk straight, to 15 ft. girth, with a broad massive crown, giving dense shade. Bark ⅔-1 in. thick, dark grey, brown or blackish, rough with numerous small fissures and exfoliating scales. Wood dull grey or dirty white, with darker streaks or patches, soft, open-grained, readily eaten by insects. The cub. ft. weighs 38-44 lb., P. between 463 and 678. In old trees small distinct heartwood of dark brown colour (R. Thompson). Used for planking, doors, and window-frames. Canoes and Massūla boats are made of it. Bark and leaves are used medicinally; a gum issues from wounds in the bark, and Lakh is produced on the tree (in Sindh, in dry years).

Mainly cultivated on account of its fruit. In North and Central India the fruit of ungrafted trees is generally stringy, with a strong turpentine flavour. It nevertheless forms an important article of food for large classes of the population. The fruit of good grafts is excellent, soft, juicy and with a delicious aromatic flavour. In Burma the Mango is not generally grafted; seeds of a good kind, as a rule, produce good fruit of a similar description. This is a remarkable fact, but it does not stand quite alone, for in other parts of India also it has been noticed that the seed of good kinds produces the same variety without grafting (Firminger Gardening, 2d ed. p. 235). It is an interesting question, whether in certain districts, or under certain circumstances only, grafting is necessary to produce a good variety of the Mango.

In Jamaica, starch is made of unripe Mangoes; the kernels are eaten in India during times of scarcity. Roxburgh states that they are first boiled in the steam of water.

6. BUCHANANIA, Roxb.

Trees with alternate, petiolate, simple, entire, coriaceous leaves. Flowers small, bisexual, in terminal and axillary panicles. Calyx small, 3-5-cleft, persistent. Petals 5, oblong, imbricate in bud. An annular disc, between ovaries and stamens, more or less crenate or lobed. Stamens 10, inserted outside the disc at its base; anthers basifixed. Carpels 5, distinct, 1 fertile, 1-celled, ovule 1, attached to a funicle proceeding from the base of the ovary; the others rudimentary, subulate. Fruit a drupe with compressed crustaceous or bony putamen, splitting into 2 valves at the time of germination.

1. **B. latifolia**, Roxb. Fl. Ind. ii. 385; Cor. Pl. 282; W. et A. Prodr. 169; Bedd. Fl. Sylv. t. 165.—Sans. *Piyāla, chāra,* Vern. *Chirauli,* Pb.; *Piāl, muria, katbhilāwa,* Garhwal, Kamaon; *Piār, peirah,* Oudh; *Chār achār,* C.P.; *Sārāka-marrah,* Gonds, Satpura range. The kernel of the fruit is called *chironji*. *Lumboben,* Burm.

Young branches, inflorescence, under side of leaves, petioles, and midrib clothed with long silky hairs. Leaves generally 6-10 in. long, oblong, obtuse, with 15-20 prominent and branched lateral nerves on either side of midrib, and shorter intermediate ones. Stipules none. Panicles terminal and from the axils of the upper leaves, pyramidal. Bracts small, caducous. Flowers whitish green, sessile. Carpels hairy. Drupe black when ripe, ½ in. long, putamen hard, bony.

A common tree of the dry forests throughout India and Burma, ascending nearly to 4000 ft. in South India, and to 3000 ft. in the outer Himalayan ranges. The Sutlej is its north-western limit in North India. Common in Sāl forests, but extends far beyond the limits of Sāl in the south. Nearly leafless for a short time during the hot season; the new leaves issue about May, and the full-grown foliage is dark green. Fl. Jan.-March; the fruit ripens in April and May, and is generally off the tree by the middle of June. A Loranthus is common on the tree.

A moderate-sized tree, 40-50 ft. high, with a straight trunk, not exceeding 4 ft. in girth in North and Central India; bark 1 in. thick, dark grey or blackish, rough, tubercled and tesselated, small quadrangular plates divided by deep narrow furrows. Sap- and heart-wood not distinct. Wood brown when fresh-cut, when seasoned greyish brown, red or pink, with white streaks, compact, even-grained, soft and light, weight 36-47 lb. per cub. ft., seasons well, is easily worked, liable to be eaten by white ants and beetles, otherwise fairly durable if kept dry. Used for boxes, bedsteads, bullock-yokes, doors, window-frames, tables, and the like. Is apt to stain clothes unless polished.

The bark is used for tanning; a pellucid gum exudes from wounds in the stem; the leaves are often used as a substitute for plates. The fruit has a pleasant, sweetish, subacid flavour, is an important article of food of the hill tribes in the Central Provinces (Gonds and Bygahs). They collect the seed and extract the kernel, which they barter for grain, salt, and cloth. The kernel tastes somewhat like pistachio-nuts; it is an important article of trade, being used largely in native sweetmeats. Oil is extracted from it.

7. **SPONDIAS**, Linn.

Trees, with alternate, imparipinnate leaves, without stipules, and small flowers in terminal, spreading panicles. Calyx small, 4-5-lobed. Petals as many, valvate or imbricate in bud. Stamens twice the number of petals, inserted under the plicate or crenate disc; anthers versatile. Carpels 4-5, at first distinct, afterwards coalescing; styles as many as carpels; ovules solitary, pendulous. Fruit a fleshy drupe, with a bony, 2-5-celled, 2-5-seeded kernel. Embryo straight, with plano-convex cotyledons.

1. **S. Mangifera**, Pers.; Roxb. Fl. Ind. ii. 451; W. & A. Prodr. 173; Wight Ill. t. 76; Bedd. Fl. Sylv. t. 169.—*Hog-plum.* Sans. *Amrātaka, kapītana.* Vern. *Amra, amāra, ambārā, amūr, bahamb, ambodha.* (*Kwayben*, Burm.)

Glabrous. Leaves near extremities of branches, 12-20 in. long; leaflets opposite, about 5 pair, short-petiolulate, elliptic-oblong, acuminate, with 10-30 parallel, nearly straight, lateral nerves on either side of midrib, joined at the ends by a prominent nerve running parallel with the edge and close under it, and reticulate veins between. Flowers white, nearly sessile, bisexual, pentamerous, fasciculate, on large, erect, diffuse, and thin panicles. Petals 5, oblong, spreading. Disc fleshy, notched. Filaments subulate, shorter than petals. Drupe ovoid, smooth, fleshy, yellow when ripe, about 1½ in. long; kernel woody, tough, fibrous outside, and rough with irregular furrows and cavities. Seeds 1-3. The flowers of this sp. seem always to be bisexual, but a few only set fruit.

Common, but not everywhere, in dry forests of many parts of India and Burma. Its north-western limit seems to be the Salt range in the Panjab. Scarce in the Central Provinces. One of the first trees to shed its leaves (Nov.), and the last to renew them, often not until the rains have set in. The mature foliage is bright green, with a peculiar smell when bruised. Fl. in April; the fruit ripens in the ensuing cold season.

In North India a small tree, 25 ft. high, 4 ft. girth; in South India and Burma a large tree. Bark thick, whitish- or brownish-grey, undulated with short longitudinal, generally shallow wrinkles. Wood soft, coarse-grained, useless. A mild tasteless gum exudes from wounds made in the bark in spring. The ripe fruit has an astringent, acid, and turpentine taste, but is eaten, and is pickled. Deer eat it greedily, and heaps of the hard kernels are found everywhere in the forests where this tree grows.

Coriaria nepalensis, Wall. Pl. As. rar. t. 289. Vern. *Massūri* (at Mussoori, whence the name), *makola* (Kamaon) is a shrub, belonging to the small order of *Coriarieæ*, with quadrangular branchlets, opposite, ovate, 3-7-nerved leaves, racemose pentamerous flowers, 10 stamens, and 5 distinct, 1-seeded carpels, attached to a conical torus, the petals enlarged after flowering, with a sharp keel inside, which is inserted in the interstices between the carpels. It is found in the Himalaya, between 2500 and 7500 ft. elevation, from near the Indus to Bhutan. The branches are browsed by sheep. The fruit is eaten, but is said to cause thirst or colic. Nearly allied to it is *C. myrtifolia*, Linn., a shrub of South Europe and North Africa, the leaves of which are used for tanning and dyeing leather, and the fruit of which is poisonous.

ORDER XXX. MORINGEÆ.

Soft-wooded trees, with alternate, impari- bi- or tri-pinnate leaves; the pinnæ and leaflets opposite; leaflets entire, caducous. In the place of stipules, glands at the base of petioles and pinnæ. Flowers large, bisexual, irregular, white or red, in axillary panicles. Calyx cup-shaped, with 5 deciduous, somewhat unequal, petaloid segments. Petals similar to calyx segments, unequal, the upper one ascending. Disc lining inside of calyx, with a short free margin. Stamens inserted on the edge of disc, 5 perfect stamens opposite to petals, and alternating with 5 (sometimes 7) filaments without anthers; anthers attached on the back, oblong, 1-celled. Ovary stipitate, lanceolate, 1-celled, with 3 parietal placentæ, and a simple slender style; ovules numerous. Capsule pod-shaped, rostrate, 3-6-angled, torulose, 1-celled, 3-valved, with numerous seeds, embedded in the fungous substance of the valves. Seeds with a straight embryo without albumen. —Gen. Pl. i. 429; Royle Ill. 180; Wight Ill. i. 186.

1. MORINGA, Juss.

(Only genus, the characters those of the order.)

1. **M. pterygosperma**, Gärtn.; W. & A. Prodr. 178; Wight Ill. t. 77; Bedd. Fl. Sylv. t. 80.—Syn. *Hyperanthera Moringa*, Roxb. Fl. Ind. ii. 368. *Horseradish*-tree. Sans. *Sobhanjana*. Vern. *Soanjna*, *sānjna*, *senjna*, *sujna*, *shajna*, North India; *Swanjera*, Sindh; *Saihan*, *sejan*, *mūnga*, *mulaka*, C.P.

Young branches, inflorescence, petioles, and young leaves clothed with short, grey, velvety pubescence. Leaves near the extremities of branches, generally tripinnate, 1-2 ft. long, on long sheathing petioles; pinnæ opposite, 4-6 pair, the lower 3-4 pair bipinnate; pinnulæ opposite, 6-9 pair, the four lower pairs generally with 3-7 leaflets, the rest consisting of single leaflets; leaflets on short slender petiolules, ovate or obovate, entire, pale beneath, lateral nerves indistinct. Petioles of pinnæ and pinnulæ articulate, with a linear hairy gland between each pair of pinnæ, pinnulæ, and leaflets. Flowers strongly honey-scented, in numerous lateral panicles at the ends of branches; bracts linear, shorter than pedicels. Petals linear-spathulate, white, with yellow dots at the base. Ovary and base of filaments hairy. Pods pendulous, 9-18 in. long, with 9 rounded longitudinal ribs; seed trigonous, winged at the angles.

Commonly cultivated throughout India and Burma, in the N.W. Himalaya to 1500 ft., introduced in other tropical and subtropical countries (Jamaica 1784). Wild in the lower Himalaya and Siwalik tract from the Chenab to the Sardah, also in the Oudh forests. Most of the old leaves shed in Dec. and Jan.; the fresh foliage appears in March and April; the flowers issue between Jan. and April, generally before the leaves are out; the pods ripen from April onward, and, unless pulled off, remain long on the tree.

A small tree, to 20 ft. high, with a straight trunk 4-5 ft. girth, and a few large divergent branches. Bark grey, soft, corky, and deeply cracked. Wood coarse-grained, spongy, soft and perishable. The tree is mainly cultivated on account of its fruit, which is eaten as a vegetable, and preserved as pickle. Leaves and flowers are likewise eaten. Twigs and leaves are lopped for fodder. Incisions are made in the trunk, from which exudes a reddish gum, used in native medicine. The root has a strong pungent flavour, much resembling horseradish ; locally applied, it acts as a vesicant (Pharm. Ind. 61). From the seeds of another species with unwinged seeds, *M. aptera*, Gærtn., of Africa, a valuable oil (the Ben-oil of watchmakers and jewellers) is obtained ; but, so far as known, no oil is extracted from the seeds of this species in India.

A second species, nearly allied to this, *M. concanensis*, Nimmo, grows wild on the dry hills of Rajputana (*Sainjna*), near Kishengurh and Bednore ; also on the hills of Sindh (*Mhūa*) and the Konkan. It has yellow flowers, and bipinnate leaves, pinnæ 4-6 pair, simply pinnate, except sometimes the lowest, which are bipinnate, with broadly ovate leaflets, 1 in. long, on petioles ⅓ in. long, with 4-6 pairs of rather prominent lateral nerves. In Rajputana I found it in leaf and flower in Dec. 1869 ; in the Konkan it is said to flower in Nov. The unripe fruit is eaten. Bark thick, soft, corky. Wood soft and light.

ORDER XXXI. LEGUMINOSÆ.

Herbs, shrubs, or trees, extremely variable in appearance. Leaves generally alternate, compound, and stipulate ; inflorescence mostly indefinite. Flowers bracteate ; calyx of 5 sepals, free or oftener connate ; petals 5 or fewer, equal or unequal. Stamens 10 or numerous, rarely hypogynous, more commonly inserted with petals on the base or inside of the calyx-tube ; anthers 2-celled, cells parallel, generally opening longitudinally. Pistil monocarpellary, rarely 2- or 5-carpellary ; ovules numerous, rarely 1 or 2, attached in 1 or 2 series to the inner suture. Fruit a pod (legume), generally dry, indehiscent, or separating into 2 valves, along one or both sutures. Seeds exalbuminous, or (in some *Cæsalpinieæ*) albuminous ; testa coriaceous, sometimes horny, rarely thinly membranous ; embryo straight, or the radicle bent upon the cotyledons, which are generally large, fleshy, or foliaceous.—Gen. Pl. i. 434 ; Royle Ill. 180 ; Wight Ill. i. 187.

This large order comprises upwards of 6500 species, distributed nearly over the entire globe. It is divided into three well-defined sub-orders—*Papilionaceæ*, *Cæsalpinieæ*, and *Mimoseæ*.

Calyx gamosepalous ; corolla papilionaceous ; petals free, unequal, imbricate, the posterior petal outside ; stamens generally diadelphous	1. PAPILIONACEÆ.
Calyx parted nearly to the base ; petals free, mostly unequal, imbricate, the posterior petal inside ; stamens free . .	2. CÆSALPINIEÆ.
Calyx gamosepalous ; petals more or less connate, equal, valvate ; stamens free or monadelphous	3. MIMOSEÆ.

FIRST SUB-ORDER, PAPILIONACEÆ.

Mostly herbs, rarely shrubs or trees. Leaves alternate, pinnate, or digitate, rarely simple ; stipules usually present ; leaflets often stipellate ; flowers bisexual, irregular. Calyx gamosepalous, often 2-lipped, the upper lip consisting of 2, the lower (anterior) of 3 sepals. Petals 5, clawed, unequal, imbricate in bud, the posterior and outside petal (standard) broad; often reflexed, the 2 anterior and inside petals (keel) often connate, the 2 lateral and intermediate petals (wings) enclosing the keel. (The standard is often called the upper petal, being commonly placed upwards with regard to the axis of the inflorescence, but as regards insertion it is the lowest of the 5 petals.) Stamens generally 10, inserted with the petals near the base or on the inside of the calyx-tube; filaments free, or connate into a tube or sheath, or the one opposite to the standard free, the claws of keel, or of keel and wings, sometimes adhering to the staminal tube; anthers versatile, rarely basifixed. Pistil monocarpellary, sessile or stipitate; style incurved; stigma oblique or terminal; ovules numerous, rarely 1 or few.. Fruit a dry legume. Seeds with a coriaceous testa, without albumen; cotyledons thick, plano-convex; the radicle accumbent upon the cotyledons.

The 20 genera here described belong to the following tribes:—

Podalyrieæ.—Stamens 10, free; leaves simple or digitate—*Piptanthus.*

Genisteæ.—Stamens 10, monadelphous; leaves simple or digitate—*Crotalaria.*

Galegeæ.—Stamens 10, diadelphous; pod 2-valved; leaves imparipinnate—*Caragana, Indigofera, Colutea, Sesbania, Millettia.*

Hedysareæ.—Stamens 9 or 10; pod articulate; leaves pinnate or trifoliolate—*Alhagi, Desmodium, Ougeinia.*

Vicieæ.—Stamens generally 10, diadelphous, pod 2-valved; leaves abruptly pinnate—*Abrus.*

Phaseoleæ.—Stamens 10, monadelphous or diadelphous; pods 2-valved; leaves imparipinnate; leaflets mostly 3—*Erythrina, Pueraria, Butea, Spatholobus.*

Dalbergieæ.—Stamens 10, monadelphous, or in 2 bundles; pod indehiscent; leaves imparipinnate—*Dalbergia, Pterocarpus, Pongamia, Derris.*

Sophoreæ.—Stamens 10, free; leaves imparipinnate—*Sophora.*

Stamens free.	
Pod flat, 2-valved; stipules connate, opposite to petiole .	1. PIPTANTHUS.
Pod moniliform, generally indehiscent; stipules distinct .	2. SOPHORA.
Stamens monadelphous, or equally diadelphous, or unequally diadelphous (the tenth stamen free).	
Pod 2-valved; leaves pinnate, rarely trifoliolate or simple.	
Spinescent shrubs; flowers solitary or in few-flowered umbels	3. CARAGANA.
Unarmed shrubs; flowers racemose.	
Flowers pink, purple, or white; pods not inflated .	4. INDIGOFERA.
Flowers yellow; pods inflated	5. COLUTEA.
Soft-wooded trees, with large flowers; leaflets numerous .	6. SESBANIA.
Climbers with flat pods.	
Leaves imparipinnate; seeds compressed . . .	7. MILLETTIA.
Leaves abruptly pinnate; seeds subglobose . . .	8. ABRUS.
Pod 2-valved; leaves trifoliolate.	
Pod 1-10-seeded.	
Trees with bright red flowers	9. ERYTHRINA.

Twiners with blue or purple flowers . . . . . 10. PUERARIA.
Pod 1-seeded.
Flowers large, orange; standard oblong; wings adhering to keel . . . . 11. BUTEA.
Flowers small, white, purple, or pink; standard broadly ovate or orbicular; wings free . . . . . 12. SPATHOLOBUS.
Pod 2-valved; leaves simple . . . . 13. CROTALARIA.
Pod articulate, generally indehiscent; leaves simple or trifoliolate.
Shrubs armed with axillary spines; leaves simple . . 14. ALHAGI.
Unarmed shrubs; leaves trifoliolate; flowers panicled . 15. DESMODIUM.
An unarmed tree; leaves trifoliolate; flowers fasciculate in short racemes . . . . 16. OUGEINIA.
Pod indehiscent, not articulate; leaves imparipinnate.
Leaflets alternate.
Flowers white, lilac, or purple; pod oblong, 1-4-seeded 17. DALBERGIA.
Flowers yellow; pod suborbicular, 1-seeded . . . 18. PTEROCARPUS.
Leaflets opposite.
Pod short, thick, edges not winged . . . . . 19. PONGAMIA.
Pod flat, edges marginate or winged . . . . . 20. DERRIS.

1. PIPTANTHUS, D. Don.

1. **P. nepalensis**, D. Don.—Syn. *Baptisia nepalensis*, Hook. Exotic Flora, t. 131.

A shrub, with alternate, digitate, trifoliolate leaves, and large bright yellow flowers. Leaflets lanceolate, entire, 2-5 in. long, sessile; common petiole less than half the length of leaflets. Stipules deciduous, connate at the outer edges, so as to appear opposite to the petiole. Flowers subverticillate, in short hairy racemes, with broad-ovate, tomentose bracts. Calyx hairy, somewhat 2-lipped. Standard erect, large, broadly obcordate, the margins reflexed. Stamens 10, free. Pod stipitate, broad-linear, 2-5 in. long, 3-10-seeded, dehiscent.

Himalaya, Sutlej to Bhutan, in shady woods 7000-9000 ft. Hardy against walls in England. Fl. May, June.

2. SOPHORA, Linn.

Trees or shrubs with imparipinnate leaves. Flowers yellow, white, or blue-violet, racemose or panicled, terminal or axillary. Calyx-teeth short. Standard erect or spreading, obovate or orbicular; wings obliquely oblong; keel-petals nearly straight, oblong, imbricate, or connate. Stamens free, or nearly so; anthers versatile. Ovary shortly stipitate, multiovulate; stigma terminal, minute. Pod usually indehiscent, or but tardily dehiscent, moniliform in our species. Seeds exalbuminous; radicle short and nearly straight, or longer and curved.

1. **S. mollis**, Wall.—Syn. *Edwardsia mollis*, Royle Ill. t. 32; *E. Hydaspica*, Edgew. Sometimes called *Himalayan Laburnum*. Vern. *Arghawān*, Afg.; *Gojār*, *ghwareja*, Trans-Indus; *Kūn*, *kohen*, *mālan*, Salt range; *Tilūn*, *tarni*, *kathi*, Chenab; *Brisari*, Ravi; *Pahar gūngri*, Kamaon.

A shrub with showy yellow flowers. Young leaves with adpressed silky pubescence; leaflets 30-40, subcoriaceous, elliptic, ½-1 in. long.

Flowers in lax axillary racemes. Pods 4-6-seeded, moniliform, the seed parts with 4 membranous wings, the seedless stalks between often ½ in. long. Seeds brown, hard, shining.

Trans-Indus. Salt range. N.W. Himalaya as far as Kamaon, ascending to 6000 ft. Fl. March, Apr.

2. *S. Griffithii*, Stocks in Hook. Journal of Botany, iv. (1852) p. 147.—Syn. *Keyserlingia Griffithii*, Boissier Fl. Orient. ii. 630—is a grey-silky undershrub, with winged pods; common in Beluchistan (3000-6000 ft.), also found in Afghanistan. 3. *S. Moorcroftiana*, Benth., of North-West Tibet (10,000-12,000 ft.), is armed with spinescent stipules and branchlets, and has unwinged pods. 4. *S. alopecuroides*, Linn.—syn. *Gœbelia alopecuroides*, Boissier Fl. Orient. ii. 628—is a large perennial herb with unwinged pods, of West Tibet (10,000-12,000 ft.) and Western Asia.

3. CARAGANA, Lam.

Low spinescent shrubs, with abruptly pinnate leaves. Calyx campanulate, placed obliquely on its pedicel. Petals long-unguiculate, claws as long, or nearly as long, as calyx; standard broad, with reflexed edges; keel obtuse, as long as wings and standard. Stamens diadelphous; anthers uniform. Ovary linear, sessile. Style filiform, incurved, glabrous; stigma terminal, minute. Pod linear, valves convex, continuous, not torulose.

Leaflets 3-7 pair, distant; pods hairy inside.	
Flowers in umbels of 2-3, on long peduncles . . .	1. *C. brevispina.*
Flowers solitary.	
Leaf-bearing branchlets, short, tubercular, in the axils of scariose bracts and stipules	2. *C. Gerardiana.*
Leaf-bearing branchlets, short, tubercular, in the axils of trifid spines, the middle spine longer	3. *C. ulicina.*
Leaflets 2 pair, approximate; pods glabrous inside . . .	4. *C. pygmæa.*

1. **C. brevispina**, Royle Ill. 198.—Vern. *Sat-bargi*, Jhelam; *Drob, burkundu*, Kashmir.

An erect shrub, with flexuose branches. Leaves generally fasciculate, on short tuberculate branchlets, rarely (on vigorous shoots) distant, with the internodes elongated. Leaf-bearing branchlets in the axils of stout spinescent petioles, 1-2 in. long, with or without leaflets. Stipules scarious, the outer frequently spinescent. Leaflets 5-7 pair, elliptic, ½ in. long, pubescent, with soft adpressed hairs. Flowers yellow, in umbels of 3-5; peduncles 2-3 in. long. Calyx, bracts, peduncles, and petioles clothed with soft tawny pubescence. Calyx-teeth shorter than tube. Pods 2-2½ in. long, pubescent or glabrate outside, villous inside.

Outer and inner ranges of the N.W. Himalaya, 5000-9000 ft.; from the Indus to the Ganges, also in Waziristan. Fl. June-Aug.

2. **C. Gerardiana**, Royle Ill. t. 34, fig. 1.—Syn. *C. spinosissima*, Benth.; Jacq. Voy. Bot. t. 43.

A diffuse spinescent tomentose shrub. Leaf-bearing branchlets short, closely approximate at the ends of branches. Stipules scarious, villous, not spinescent. All petioles spinescent, the lower part of the leaf-bearing branchlets closely set with leafless spinescent petioles. Leaflets 3-5 pair, elliptic, mucronate, villous, ⅓ in. long. Flowers yellow, solitary, peduncles shorter than calyx. Calyx-teeth shorter than tube. Pods 1 in. long, tomentose inside and outside.

Inner N.W. Himalaya (7000-12,000 ft.) Kunawar, Garhwal, Kamaon. Fl. May-Aug.

3. **C. ulicina,** Stocks; Hook. Journ. Bot. iv. (1852) 145; Boissier Fl. Orient. ii. 199.

A low thorny shrub. Leaves fasciculate in the axils of stout trifid spines; the middle spine (petiole) often with a few leaflets, 1-1½ in. long, the 2 lateral much shorter. Leaflets 2-3 pair, grey with adpressed hairs, obovate or elliptic, mucronate, less than ½ in. long; lateral nerves prominent. Flowers yellow, solitary; peduncles as long as, or longer than, calyx. Pod pubescent outside and inside, 1 in. long.

Common in the hills of Beluchistan, ascending to 6000 ft. (Shah-Bilawal, near Karāchi); Waziristan, 2000-8000 ft. *C. ambigua,* Stocks l. c. (vern. *Shinalak*), the flowers eaten by the Brahuis in Beluchistan, seems to be only a variety. It is said to differ by larger flowers, and the pods slightly curved at the top.

4. **C. pygmæa,** DC.—Syn. *C. versicolor,* Benth. in Royle Ill. 198. *Genista versicolor,* Wall. ibid. t. 34, f. 2; *Tartaric furze.*—Vern. *Dāma, tāma, trāma,* Ladak.

A small thorny glabrous shrub, branches striate. Leaves fasciculate, or on short tuberculate branchlets, in the axils of sharp trifid shining brown spines, the middle spine (petiole) longer, about ½ in. long. Leaflets 2 pair, ½ in. long, closely approximate, linear or oblanceolate; common petiole very short, terminated by a spine. Flowers bright reddish-yellow, solitary, peduncles jointed, as long as calyx. Calyx-teeth shorter than tube.

Common in the inner arid valleys of the N.W. Himalaya, and on the plains of Western Tibet, from 12,000-16,000 ft. On the Safedkoh at 8000-9000 ft. Siberia, from the Altai to Davuria. Fl. Sept. Gregarious, somewhat resembling furze. Browsed by goats, and extensively used as fuel.

C. crassicaulis, Benth., is a small alpine undershrub, in the inner arid ranges of Kamaon and Sikkim. 13,000-16,000 ft., with reddish-yellow flowers, and stiff, but not spinescent petioles.

4. INDIGOFERA, Linn.

Herbs or shrubs, generally clothed with adpressed silky hairs often fixed by the middle. Leaves imparipinnate simple or trifoliolate. Calyx small, oblique, campanulate, or tubular; teeth equal, or the lowest longer than the rest. Standard ovate or orbicular; wings oblong, adhering a little to the keel, which is straight, not rostrate, spurred on each side near the base. Upper stamen free from the base, the others connate; anthers uniform, the connective forming an apiculus. Ovary sessile or nearly so, usually with numerous ovules; style glabrous; stigma capitate. Pod linear or oblong, rarely globose, straight or curved, terete tetragonous or compressed, generally filled with a dry spongy mass which separates the seeds.

Calyx-teeth lanceolate, as long as the cup-shaped calyx-tube.	
Leaflets 6-15 pair; pods spreading	1. *I. heterantha.*
Leaflets 4-6 pair; pods deflexed	2. *I. tinctoria.*
Calyx-teeth triangular, shorter than the campanulate calyx-tube; leaflets 4-6 pair; pods spreading	3. *I. atropurpurea.*

1. **I. heterantha,** Wall.—Syn. *I. polyphylla,* Edgeworth. Vern. *Khenti, kāthi, kāthu, kati, kathewat, mattu, kaskei, kütz, kuts, katsu, shāgali,* Pb.

A shrub, strigose with grey adpressed hairs. Leaves imparipinnate, common petiole 1½-2½ in. long. Leaflets opposite, 6-15 pair, oblong, or elliptic-oblong, mucronate, less than ½ in. long. Stipules subulate, deciduous. Racemes short-pedunculate, as long as leaves; bracts subulate, deciduous. Calyx cup-shaped, the teeth longer than, or as long as, tube. Pod spreading, straight cylindric, 1¼ in. long, shining, with a few scattered hairs.

Common in the outer North-West Himalaya, and on the eastern skirts of the Suliman range, ascending to 8000 ft. Fl. May, June. In Kashmir and elsewhere the twigs are largely used for basket-work, and in some cases they form part of the twig-bridges. *I. Gerardiana,* Wall., with larger flowers and a less number of leaflets, is probably only a variety of this species.

2. **I. tinctoria,** Linn.; Roxb. Fl. Ind. iii. 379; W. & A. Prodr. 202; Wight Ic. t. 365. *The Indigo plant.*—Sans. *Nīli.* Vern. *Nīl.*

Branches, inflorescence, and leaves thinly silky. Leaves imparipinnate; common petioles 3-4 in. long, firm, erect; stipules small, setaceous; leaflets 4-6 pair, opposite, on short petiolules, oblong or obovate, ½-¾ in. long, turning black when dried. Racemes axillary, lax, with about 20 greenish rose-coloured flowers, at first shorter than, and ultimately equalling, the leaves. Pedicel shorter than the silvery calyx; calyx-teeth lanceolate, reaching half-way down. Pods deflexed, 1-1½ in. long, thick, nearly cylindrical, straight or nearly so, glabrous when mature, 8-12-seeded.

Cultivated in the southern and eastern Panjab, ascending on the Chenab to 2000 ft. Rare in the Peshawar valley. Grown extensively in Bengal, Sindh, and South India. Cultivated in tropical Africa and America. Wild in Senegambia.

A perennial undershrub, but generally grown in India from seed as an annual or biennial plant. The stems are cut when in blossom or before they come into flower, steeped in water, and under the influence of fermentation and free access of air Indigo is formed. The juice of the fresh plant does not contain Indigo ready formed, but a colourless substance, the nature of which is not yet accurately known, and which is converted into Indigo during the process of manufacture in the Indigo vats. Dioscorides and Plinius mention Indigo as a dye used in Egypt and India; its general use in Europe dates from the sixteenth century. Indigo may be obtained in small quantities from other plants—*Isatis* (Cruciferæ), Europe, *Wrightia tinctoria* and *Marsdenia tinctoria,* both included in this Flora, *Polygonum tinctorium* (Polygoneæ), China, and others.

Nearly allied are two other species, which likewise yield Indigo: 1. *I. Anil,* Linn., with racemes shorter than leaves, and sickle-shaped pods. Cultivated largely in tropical Africa, and which, according to Macfadyen's Flora of Jamaica, i. 245, supported by Grisebach, Flora of the Brit. West Indies, 181, is indigenous in Jamaica. To this species some cultivated forms from Burma and other parts of India may be referred. There are intermediate forms between I. *Anil* and *tinctoria*, and possibly they may have to be considered as one species, indigenous in America and Western Africa. 2. *I. argentea*, Linn., probably identical with *I. cærulea*, Roxb. Fl. Ind. iii. 377, Wight Ic. t. 366, with 4 pairs of obovate leaflets, on both sides permanently silvery, and short, thick, curved, 3-4-seeded pods, wild in the Beluchistan hills, Sindh, and (*I. cærulea*) in South India; wild and cultivated in the Barbary States, Egypt, and Arabia. The cultivated forms of Indigo in India demand further examination.

3. **I. atropurpurea**, Hamilton; Roxb. Fl. Ind. iii. 381; Wight Ic. t. 369.—Vern. *Khenti, jand*, Kaghan; *Kathi, gorkatri*, Kashmir; *Kala sakena, sakna*, Kamaon.

A large shrub, nearly glabrous, young parts with scattered adpressed hairs. Leaves imparipinnate; common petioles 6-10 in. long, spreading; leaflets opposite, on short petiolules, 5-6 pair, ovate-oblong, mucronate, 1½ in. long. Stipules early caducous, stipels setaceous at the base of leaflets. Flowers dark purple. Racemes as long as, or longer than, the leaves; bracts lanceolate, longer than buds. Calyx with scattered white hairs; teeth short, triangular. Pods spreading, reticulate, glabrous, marginate, straight, linear, compressed, 1½ in. long, with 10 seeds.

Salt range, 2500-5000 ft. Abundant in the outer Himalaya from Hazara to Nepal, generally between 2000 and 9000 ft., descending occasionally to 1200 ft. in the Siwalik hills. In Pangi on the upper Chenab between 8000 and 9000 ft. Kasia hills. The twigs are used for basket-work and for twig-bridges.

Of the numerous other shrubs and undershrubs of this genus which are found in North and Central India, I will only mention: 1. *I. pulchella*, Roxb. Fl. Ind. iii. 382.—Syn. *I. arborea*, Roxb. ib. 381; Wight Ic. t. 368; *I. violacea*, Roxb. ib. 380.—Vern. *Sakena*, Kamaon. A large shrub, with rose-coloured or violet flowers, hairy; leaflets 6-10 pair, obovate-oblong, obtuse, or emarginate; bracts longer than flower-buds, and calyx-lobes triangular. South India, Bengal, N.W. India, ascending to 5000 ft. in the outer Himalaya. Fl. Jan.-June. 2. *I. linifolia*, Linn.; Roxb. Cor. Pl. t. 196; Fl. Ind. iii. 370; Wight Ic. t. 313; W. & A. Prodr. 198.—Vern. *Torki*, Pb.; *Bhangra*, Bengal. A small cæspitose undershrub, common throughout the plains of India, with simple, linear leaves and small globose 1-seeded pods.

5. COLUTEA, Linn.

Shrubs with imparipinnate leaves. Stipules small. Flowers yellow or reddish, rather large, in few-flowered axillary racemes. Calyx-teeth subequal, or 2 upper shorter. Standard rotundate, bi-plicate or bi-callose at the base, shortly clawed; wings falcate-oblong; keel-petals incurved, obtuse, with long connate claws. Vexillary stamen free; anthers uniform. Ovary stipitate multiovulate; style longitudinally bearded above; stigma subapical. Pod membranous, inflated, indehiscent or opening at the top. Seeds reniform, funiculate.

1. **C. nepalensis**, Sims. Bot. Mag. t. 2622; Bot. Reg. t. 1727. *Nepal Bladder Senna.*—Vern. *Brāa*, Ladak.

A shrub, with smooth, reddish-brown bark, and fascicled branchlets. Leaves glabrous; common petiole 2-4 in. long; leaflets 7-9, oval or obovate, ¼-½ in. long; lateral nerves indistinct. Flowers large, greenish yellow, in slender, drooping racemes. Pod membranous, inflated, about 2 in. long, hairy.

Arid valleys of the inner Himalaya. Ladak, Piti, Kunawar, Kamaon (8000-11,500 ft.) Fl. July, Aug. Hardy in England. The pods open before they ripen; and in general appearance, also, the plant is different from the *common Bladder Senna* (*C. arborescens*, Linn.) It is a subject for further inquiry whether it is near *C. orientalis*, Miller (*C. cruenta*, Aiton; Boissier Fl. Orient. ii. 195).

6. SESBANIA, Pers.

Herbs or small soft-wooded trees, of brief duration, with abruptly pinnate leaves, numerous deciduous leaflets, and middle or large sized flowers in axillary racemes. Calyx broad-campanulate, with short, nearly equal teeth. Petals distinctly unguiculate; standard large, emarginate, oblong or orbicular; wings oblong. Stamens diadelphous; anthers uniform or nearly so. Ovary multiovulate; style glabrous, incurved; stigma capitate. Pod long, narrow, linear, dehiscent.

Flowers ½ in. long; leaflets linear-oblong . . . 1. *S. ægyptiaca.*
Flowers 3 in. long; leaflets oblong . . . . . 2. *S. grandiflora.*

1. **S. ægyptiaca**, Pers.; Wight Ic. t. 32; W. & A. Prodr. 214; Boissier Fl. Orient. ii. 193.—Syn. *Æschynomene Sesban*, Linn.; Roxb. Fl. Ind. iii. 332. Sans. *Jayanti, jaya.* Vern. *Jait, jhijan, janjhan*, Pb.; *Dhandiāin*, Rohilk.; *Jayanti*, Beng.; *Shewarie, sheveri*, Dekkan.

A soft-wooded tree, 8-12 ft. high, of a few years' duration. Nearly glabrous, extremities and young leaves slightly pubescent. Common petiole unarmed, 4-6 in. long; leaflets opposite, 10-20 pair, on short petioles, oblong-linear, ¾-1 in. long, blunt, with a faint mucro, the lowest pair near the base. Racemes lax, 6-12 flowered, nearly as long as leaves; pedicels spreading, longer than calyx. Calyx-teeth short triangular. Petals ½ in. long, yellow, or orange and purple. Pod 6-8 in. long, narrow-linear, valves convex, torulose; seeds 20-30.

Commonly cultivated and naturalised in many parts of India; in the Panjab as far as Peshawar. Ascends to 4000 ft. in the North-West Himalaya. Cultivated throughout the tropics; wild in tropical Africa. Fl. autumn and C.S. Grown in the drier parts of the Dekkan to furnish poles as a substitute for the bamboo; rope is made of the bark, the wood is used to boil Jaggery, and the leaves and branches as cattle-fodder. On the rich alluvial banks of the Kistna and Warna rivers in the Dekkan, which are submerged during the annual floods, it is grown from seed as an annual, attaining 15-20 ft. in one season. In the Sattara district it is grown with *Melia Azedarach* and *Moringa pterygosperma* to shade and support the Betel vine, in thickets 20 ft. high.

2. **S. grandiflora**, Pers.—Syn. *Agati grandiflora*, Desv.; W. & A. Prodr. 215; *Æschynomene grandiflora*, Roxb. Fl. Ind. iii. 330. Sans. *Vaka.* Vern. *Basna*, Hind.; *Buka*, Beng.; *Agati*, Tamil.

A short-lived, soft-wooded tree, attaining 20-30 ft. Nearly glabrous, extremities and young leaves slightly pubescent. Common petiole unarmed, 6-9 in. long; leaflets opposite, on short petiolules, 10-30 pairs, oblong, obtuse, and often mucronate, glaucous, 1-1½ in. long. Racemes short, with 2-4 very large flowers, 3 in. long, red or white. Calyx campanulate, from a turbinate base, with short, unequal teeth. Standard ovate, rather shorter than the keel. Pod upwards of a foot long, ⅓ in. broad, compressed, tetragonous.

Cultivated in Southern and Eastern India, and in the Ganges Doab. Indigenous in the Indian Archipelago and in North Australia. Wood white, only fit for fuel. The tender leaves, pods, and flowers are eaten as a vegetable, and in Bengal the tree is grown as a support for the Betel plant.

7. MILLETTIA, W. & A.

Climbing shrubs, with imparipinnate leaves; leaflets prominently penniveined. Flowers white, rose, or purple, racemose or panicled. Calyx truncate or shortly toothed, 2 upper teeth sometimes connate. Standard large-spreading or reflexed, shortly clawed, with or without basal calli or auricles; wings oblong, falcate; keel-petals incurved, obtuse. Vexillary stamen free at base, connate with the rest at the middle or wholly free; anthers uniform. Ovary multiovulate; stigma small, terminal. Pod from linear to oblong, flat or thick, coriaceous or woody, indehiscent or tardily dehiscent.

1. **M. auriculata**, Baker MSS.—Syn. *Robinia macrophylla*, Roxb. Fl. Ind. iii. 329; *Pongamia macrophylla*, Graham; *Otosema macrophylla*, Bentham. Vern. *Maudh*, Oudh; *Gonjha*, Kamaon.

A large pubescent climber, young leaves with soft silky hairs. Leaflets 7-9, 2-6 in. long, oblong, obovate-oblong or obovate, shortly and abruptly acuminate; naked part of common petiole below the lowest pair of leaflets equal to half its entire length. Stipules falcate, silky-tomentose, ⅓ in. long. Flowers white, in slender axillary racemes, about half the length of leaves. Standard auriculate above the claw. Pods rusty-tomentose, flat, linear, hard-coriaceous, 4-6 in. long, ½ in. broad.

Sub-Himalayan tract, Sutlej to Bhutan, ascending to 3500 ft. Oudh forests. Behar. Satpura range. Fl. April-June.

To the tribe of *Galegeæ* belongs also *Tephrosia candida*, DC.; W. & A. Prodr. 210.—Syn. *Robinia candida*, Roxb. Fl. Ind. iii. 327. Vern. *Lehtia*, Kamaon. A large shrub; leaflets 10 pair, lanceolate, 1½-2½ in. long, clothed with soft pubescence. Flowers white, 1 in. long, in terminal racemes. Pods linear, 3-4 in. long, ¼ in. broad, clothed with soft, tawny tomentum. Burma, Bengal, sub-Himalayan tract to Sutlej. Fl. C.S. The leaves are employed to poison fish.

8. ABRUS, Linn.

Climbing shrubs, with abruptly pinnate leaves. Calyx truncate, or with short teeth. Standard ovate, narrowed into a broad short claw, more or less adherent to the staminal tube; wings narrowly falcate, oblong; keel longer and broader than wings, arcuate. Stamens 9, connate in a sheath slit above, the tenth absent; anthers uniform. Ovary subsessile, multiovulate; style short, incurved, beardless; stigma capitate. Pod flat, 2-valved, divided by transverse membranes between the seeds.

1. **A. precatorius,** Linn.; Roxb. Fl. Ind. iii. 257; W. & A. Prodr. 236.—Sans. *Gunja, kānchi.* Vern. *Gunchi, kūnch,* (the seed *rakti, rattika*).

Nearly glabrous, young parts with scattered adpressed hairs. Common petiole 2-4 in. long, terminating in a bristle. Leaflets deciduous, opposite, nearly sessile, 10-15 pairs, the lowest pair near the base, oblong, blunt, often mucronate, ½-¾ in. long; stipules linear-subulate. Flowers rose-coloured or white, fasciculate on short pedicels, in dense axillary pedunculate racemes; peduncles 2-4 in. long, often leaf-bearing. Pod 1-1¼ in. long, ½ in. broad, oblong, rostrate, coriaceous, hairy when young. Seeds 4-5, subglobose or ellipsoid, generally red, with a black eye on the hilum, or more rarely white, or black with a white eye.

A climber, with a woody stem and slender herbaceous branches, common in most forest-tracts of the moister regions of India, ascending in the Sub-Himalayan tract to 3500 ft. Fl. at the close of the rains. The seeds are used as weights (1½-2 grains) by jewellers; the root is a bad substitute for liquorice (the root of *Glycyrhiza glabra,* Pharm. Ind. 75).

9. ERYTHRINA, L.

Trees, shrubs, or herbaceous undershrubs; young branches often prickly. Leaves trifoliolate, the lateral leaflets opposite; stipules small; stipels glanduliform. Flowers large, generally red, in fascicles of 2 or 3, forming axillary or terminal racemes. Calyx spathaceous, truncate, 5-dentate or bilabiate. Standard sessile or unguiculate, much larger than wings and keel. Stamens connate to the middle, the upper one free or connate at the base with the rest; anthers equal. Ovary stipitate, with numerous ovules; style incurved; stigma small, terminal. Legume stipitate, narrowed at both ends, opening more or less completely into 2 valves. Seeds ovoid; hilum lateral, oblong.

Calyx spathaceous, splitting longitudinally on the upper side, apex contracted, 5-toothed; petals of keel free . .	1. *E. indica.*
Calyx campanulate, bilabiate; petals of keel connate . .	2. *E. suberosa.*
Calyx campanulate, truncate, indistinctly toothed; petals of keel connate in the middle	3. *E. arborescens.*

1. **E. indica,** Lam.; Roxb. Fl. Ind. iii. 249; W. & A. Prodr. 260; Wight Ic. t. 58. The *Indian Coral-tree.*—Sans. *Mandāra.* Vern. *Pangra, panjira, pangara.*

Glabrous, inflorescence and young leaves clothed with stellate pubescence. Branches armed with numerous black prickles, petioles and leaves unarmed. Leaflets broad-ovate, short-acuminate, entire, from a truncate or somewhat cordate base, the terminal leaflet largest, often 7 in. broad and 6 in. long; lateral nerves 4-6 on either side of midrib. Racemes one or several near the ends of branchlets, 8-12 in. long, projecting horizontally at a right angle from the branchlet; flowers numerous, large, of a bright dazzling scarlet, in fascicles of 3, almost verticillate, on pedicels ½ in. long. Calyx spathaceous, half or one-third the length of standard, contracted and 5-toothed at the top. Standard oblong, erect, narrowed into a claw, wings and keel equal and conform, about 4 times shorter than standard, petals of keel distinct. Stamens monadelphous at base, higher up the tenth stamen distinct. Legume 6-12 in. long, cuspidate, protuberant at the seeds, black and wrinkled when ripe, with 1-8 oblong, smooth, red or purple seeds.

Cultivated throughout India and Burma. Wild in Bengal, Burma, South India, and in the Gonda forests of Oudh. Old leaves shed early in autumn, the young foliage issues in March and April. Fl. in February, March, before the leaves appear; pods ripen from May-July. Grows readily from cuttings.

A moderate-sized tree of rapid growth, with straight trunk and numerous branches, the branchlets armed with prickles to the third or fourth year. Bark thin, yellowish or greenish cinereous, smooth, shining, with longitudinal whitish cracks. Wood white, light and soft (called *Mochi* wood in Madras), much used for light boxes, toys, scabbards, trays, and planking. Does not warp or split, varnishes well; much of the lacquered ware of different parts of India is made of it. Planted largely in Bengal and South India to support the Betel and black-pepper vine; also in hedges.

2. **E. suberosa,** Roxb. l. c. 253; W. & A. Prodr. 260.—Vern. *Gūlnashtar, pariāra, thab,* Pb.; *Dauldhāk, rūngra, rowānra, madāra,* N.W.P.; *Nasūt,* Oudh; *Pāngra,* C.P.

Young branches, leaves, and inflorescence covered with a soft tomentum of long bi- or tri-furcate hairs. Branchlets armed with scattered, white, shining, conical prickles; petioles and leaves generally unarmed, sometimes with a few scattered prickles. Leaflets rhomboid, entire, underneath pale and tomentose, or covered with adpressed hairs. Racemes 1-4, near ends of branchlets, 4-5 in. long; flowers scarlet, in fascicles of 2-3, on pedicels ¼ in. long, smaller than those of *E. indica.* Calyx 2-lipped. Standard oblong, narrowed into a short claw, 5-6 times longer than calyx, more than twice the length of the keel; petals of keel connate, broad, many times larger than the minute falcate wings. Stamens monadelphous. Legume about 5 in. long, cylindrical, contracted between seeds, acuminate, with 2-4 glabrous black seeds.

Common wild in the Siwalik tract and lower Himalaya, from the Ravi to the Sarda, ascending to 3000 ft., occasionally found at 4000 ft. Oudh, the Central Provinces, and not uncommon in South India. Frequently cultivated. Old leaves shed in January, young foliage issues in March and April, shortly before the flowers appear. Pods ripen in June. Cuttings, even of large branches, take root readily, and grow well. A moderate-sized tree, 40-50 ft. high, with an erect trunk, 3-4, at times 6 ft. girth. Branchlets shining grey, armed with prickles to the third year. Bark corky, deeply cracked, and with longitudinal furrows, the old scales pale brown, the younger bark green-coloured. Wood white, soft, light, but fibrous and tough. Used extensively for scabbards, sieve-frames, and occasionally for planking.

3. **E. arborescens,** Roxb. Cor. Pl. t. 219; Fl. Ind. iii. 256.—Vern. *Rūngara,* Kamaon.

Young parts clothed with short, soft, ferruginous pubescence. Leaflets glabrous when full grown, broadly ovate on a cordate base, entire, long acuminate, with 5-7 lateral nerves on either side of midrib. Petiole twice the length of leaflets, with a few scattered prickles. Racemes erect, axillary, on long peduncles; flowers large, of a vivid scarlet, in fascicles of 3, each fascicle supported by a deciduous, ovate bract; pedicels ¼ in. long. Calyx campanulate, truncate, indistinctly 5-toothed. Standard obovate, boat-shaped, claw ¼ in. long; wings a little shorter than keel, obovate; petals of keel free at the base and apex, semiovate. Legumes stalked, brown-tomentose, pendulous, incurved, cuspidate, with 2-10 seeds.

Outer Himalaya from the Ganges to Sikkim, at elevations between 4000 and 6500 ft. Kasia hills. Occasionally planted in Sindh and elsewhere. A small tree, fl. Aug.-Oct.

This is probably the tree which Madden calls *E. strictá*; but *E. stricta*, Roxb., Bedd. Fl. Sylv. t. 175, with spathaceous calyx and minute wings, is a different species of the western coast.

A herbaceous species, *E. resupinata*, Roxb. Fl. Ind. 257, Pl. Cor. t. 220, is found on grass-lands of the Himalayan Terai. From a perennial underground root-stock, spring in March short racemes with large bright scarlet flowers, calyx 2-lipped, and standard resupinate—that is, bent downwards. After the flowers, appears a short herbaceous, leaf-bearing stem, which withers after the rains.

10. PUERARIA, DC.

Twining shrubs, with large pinnately trifoliolate, stipellate leaves. Flowers blue or purplish, racemose. Two upper calyx-lobes connate into an entire or bidentate lip. Standard rotundate, with basal auricles; wings oblong- or obovate-falcate, usually connate with the nearly straight or incurved keel-petals. Vexillary stamen wholly free, or cohering with the rest at the middle; anthers uniform. Ovary sessile, multiovulate; stigma small, capitellate. Pod flat or subterete, continuous, or septate between the seeds, membranous or coriaceous. Seeds rotundate or transversely oblong.

1. **P. tuberosa**, DC.; Wight Ic. t. 412; W. & A. Prodr. 205.—Syn. *Hedysarum tuberosum*, Roxb. Fl. Ind. iii. 363. Vern. *Siāli*, *saloha*, *badār*, Pb.; *Bilai kand*, *billi*, *birali*, *pona*, Kamaon.

A twining shrub, with woody tubercled stems, running over high trees. Leaves large, trifoliolate, pubescent; common petiole 5-8 in. long; leaflets 4-6 in. long, 3-5 in. broad, ovate, acuminate, the two lateral unequal-sided. Flowers bright blue, in long panicled racemes. Legumes flat, covered with long rusty hairs, 2-3 in. long, 2-6-seeded, much contracted between the seeds.

Sub-Himalayan tract, from the Indus to Sikkim, ascending to 4000 ft. Oudh forests. Bengal, the Konkan, Canara. Leafless during the cold and hot season. Fl. March, April. The large tuberous roots are eaten; they are also used for poultices and as a cooling medicine; from Kamaon they are exported to the plains.

11. BUTEA, Roxb.

Trees or large climbers, with trifoliolate leaves. Leaflets stipellate, the 2 lateral opposite. Flowers large, orange-coloured, in fascicles of 2-5, arranged in racemes or panicles, with linear, deciduous bracts. Calyx silky inside; the 2 upper teeth connate into a broad, entire, or emarginate lip. Standard oblong, acute, without appendages, recurved; wings falcate, adhering to the keel; keel acute, incurved, as long as the standard or longer. Upper stamen free, the others connate beyond the middle; anthers uniform. Ovary sessile, or short-stipitate; style long, curved, not bearded. Legume short-stalked, oblong or broad-linear, coriaceous, 1-seeded and 2-valved at the top, flat, indehiscent below.

A tree; pedicels twice the length of calyx . . . 1. *B. frondosa.*
A climber; pedicels three times the length of calyx . 2. *B. superba.*

1. **B. frondosa**, Roxb. Cor. Pl. t. 21; Fl. Ind. iii. 244; W. & A. Prodr. 261; Bedd. Fl. Sylv. t. 176.—Sans. *Palāsa.* Vern. *Dhāk*, *palās*, *chichra*, North India; *Chulcha*, Bandelkhand; *Chiūla*, *palās*, *pursha*, C.P.; *Kakria*, *khakra*, *khakro*, Banswara and Panch Mehals; *Mur-marra*, Gonds, Satpura.

Young parts downy or tomentose with soft simple hairs. Stipules linear-lanceolate, stipels subulate, both tomentose and deciduous. Leaflets coriaceous, hard, clothed with adpressed hairs beneath, and a few scattered hairs above, emarginate, or rounded at the top, the terminal leaflet broadly obovate from a cuneate base, generally as long as broad, 4-6 in. long, the lateral leaflets oblique-ovate, smaller; lateral nerves 4-8 on either side of midrib, joined by numerous prominent reticulate veins. Flowers fasciculate, in rigid racemes, pedicels twice the length of calyx. Branches of inflorescence, bracts, and calyx densely clothed with soft ferruginous hairs. Legumes pendulous, tomentose, 4-6 in. long, 1½-2 in. broad; seed oval, flat, smooth, brown 1½ in. long, 1 in. broad.

A common tree throughout India and Burma, the Jhelam river its north-western limit. Ascends to 3000, occasionally to 4000 ft. in the N.W. Himalaya. Often gregarious. Thrives on the stiff black soil of Central India and the Dekkan, and on saline soils of the Panjab. The old leaves shed in Feb., the young foliage issues in April, May, usually preceded by the scarlet flowers. The tree in full bloom presents a striking spectacle, like fire on the horizon. The fruit ripens in June, July. Inhabits the open country, not found in thick forests.

A moderate-sized tree, 40-50 ft. high, with a crooked, often irregular trunk, 6-8, at times 10-12 ft. girth, and few crooked branches. In N.W. India often kept down as a shrub by constant lopping. Bark ½ in. to 1 in. thick, spongy, inner substance fibrous, outside grey or light-brown, rough, undulated. Wood coarse and open-grained, with prominent medullary rays; weight 31-36 lb. per cub. ft. Its transverse strength P.=335 (Kyd). Not durable except under water, readily eaten by insects. (Said to be durable in Guzerat.) In North-West India used for well-curbs and piles. The bark of the root yields a fibre, used for caulking boats on the Ganges and other rivers, also for slow-matches and coarse cordage.

From natural fissures and incisions made in the bark, issues during the hot season a red juice, which soon hardens into a ruby-coloured, brittle, astringent gum, similar to kino, and sold as Bengal Kino (Pharm. Ind. 74). In Oudh and throughout Central India, lac is collected on the branchlets of this tree; the insect is often propagated by cutting a branch with the coccus on it, and fixing it on a fresh tree.

The leaves are used as plates, instead of paper to wrap up parcels, and they are given as fodder to buffaloes. The flowers (*Kāsu*, North India; *Kisu*, Guzerat) are collected, and made (with alum) into the fleeting yellow dye used in the Holi festival; they are also used medicinally. The seeds are given as purgative and anthelmintic, mostly in veterinary practice.

2. **B. superba,** Roxb. Cor. Pl. t. 22; Fl. Ind. iii. 247.

A gigantic climber, stems as thick as a man's leg. Leaflets membranous, acuminate, the terminal 6-15 in. long, lateral oblique, smaller. Flowers larger than those of *B. frondosa*, of a gorgeous orange-colour, on pedicels 3 times the length of calyx, in lax paniculate racemes.

Forests of Burma, Bengal, Oudh, the Circars, the northern Konkan, and the Dehra Doon. Fl. March. Yields kino like the preceding species.

12. SPATHOLOBUS, Hasskarl.

Large climbers, with trifoliolate leaves; leaflets stipellate, the 2 lateral opposite. Flowers small, white, purple, or pink, numerous, fasciculate on the branches of large compound panicles, with small, narrow bracts and bractlets. Calyx 4-dentate, the 2 upper teeth connate in 1. Standard broad-ovate or orbicular, obtuse, without appendages, longer than keel; wings obliquely oblong, free; keel obtuse, nearly straight, shorter than wings. Stamens, ovary, and legume like Butea.

1. **S. Roxburghii,** Benth.—Syn. *Butea parviflora*, Roxb. Fl. Ind. iii. 248; W. & A. Prodr. 261; Wight Ic. t. 210.—Vern. *Mula, maula*, N.W.P.

Inflorescence, calyx, petioles, and under side of leaflets pubescent. Leaflets obovate, acuminate, longer than broad, 6-8 in. long; lateral nerves 6-8, arcuate, anastomosing by intramarginal veins. Flowers whitish, in fascicles of 3, in large terminal and lateral panicles, pedicels as long as calyx. Teeth of calyx nearly as long as tube. Standard twice the length of calyx, emarginate. Legumes 4-5 in. long, 1 in. broad, on a distinct pedicel, 1 in. long, seed part tomentose.

A powerful climber, common in the forests of Burma, Bengal, Oudh, and the Sub-Himalayan forests as far as the Jumna river. Also in the Circars and the southern part of the Konkan. One of the principal climbers in the Oudh Sāl forests. Fl. Dec., Jan.; fr. April.

Several large and remarkable forest-weeds belong to the genus *Flemingia*, which is generally classed under *Phaseoleæ*: 1. *F. Chappar*, Ham., and 2. *F. strobilifera*, Brown (*Hedysarum strobiliferum*, Roxb. Fl. Ind. iii. 350), with simple leaves, those of the former long-petiolate, cordate, those of the latter ovate, on short petioles. Both species have spikes with large membranous inflated bracts, enclosing the flowers. *F. strobilifera* is common throughout India, and often attains 8 ft. The leaves are used for thatching. *F. fruticulosa*, Wall., is a suffruticose variety of *strobilifera* in the North-West Himalaya. *F. Chappar* is found in Burma, Bengal, Gorakhpur, and the sub-Himalayan tract to the Jumna. Three other species have trifoliolate leaves,—viz., 3. *F. lineata*, Roxb. Fl. Ind. iii. 341, common nearly throughout India, flowers in paniculate racemes, with small bracts; 4. *F. congesta*, Roxb. Fl. Ind. 341, Wight Ic. t. 390, which is closely allied to, if not synonymous with, *F. semialata*, Roxb., Wight Ic. t. 326, common nearly throughout India, flowers in dense axillary bracteate spikes; and 5. *F. involucrata*, Benth. in Pl. Junghuhn. 246, sub-

Himalayan tract from Assam to Kamaon; flowers in subsessile heads with large tomentose, ovate-lanceolate bracts.

13. CROTALARIA, Linn.

Herbs or shrubs, with simple or digitately 3-foliolate (rarely 5-7-foliolate) leaves. Stipules free or decurrent, sometimes small or none. Flowers yellow blue or purplish, usually in terminal or leaf-opposed racemes. Calyx-lobes distinct, or calyx more or less bilabiate. Standard orbicular or ovate, usually callous at base, shortly clawed; wings obovate or oblong; keel-petals beaked. Stamens monadelphous in an open sheath; anthers unequal, alternately basifixed and versatile. Ovary 2-∞-ovulate; style bearded. Pod globose or oblong, turgid, 2-valved.

1. **C. Burhia**, Hamilton; Benth. in London Journal of Botany, ii. (1843) 474; Boissier Fl. Orient. ii. 26.—Vern. *Sīs, sissāi, meini, pola*, Trans-Indus; *Khep, khip, khippi, būta, bhata, būi*, Pb.; *Lāthia, kharsan, kauriāla*, Harriāna, Delhi.

An erect or procumbent shrub, with slender, close-set entangled branches, flexible and rush-like when young, stiff and rigid when old. Leaves small and scanty, oblong or linear, generally less than ½ in. long, more or less pubescent. Flowers yellow with red veins, on short pedicels, far apart in long racemes, forming terminal rigid divaricate panicles. Legume short, villous, 1-3-seeded, twice the length of calyx.

Common in the plains of Sindh and the Panjab, Peshawar valley, in dry sandy places. Fl. Nov.-March. Ropes are made of it in the Panjab, and it is browsed by cattle.

Crotalaria juncea, Linn.; Roxb. Cor. Pl. t. 193; Fl. Ind. iii. 259.—Sana. *Sana.* Vern. *Sann, sanni* (*Taag*, Bombay). The well-known Indian hemp; is cultivated throughout North-West India for its fibre. Several other large herbaceous species of *Crotalaria* are common weeds in the forests.

14. ALHAGI, Desv.

Calyx campanulate, with 5 small acute teeth. Petals unguiculate, claws nearly as long as calyx; standard broad; keel blunt. Stamens diadelphous, anthers uniform. Ovary linear, sessile; style filiform, incurved. Pod linear, generally moniliform, contracted between seeds, rarely continuous.

1. **A. Maurorum**, Desv.; W. & A. Prodr. 232. — Syn. *Hedysarum Alhagi*, Willd.; Roxb. Fl. Ind. iii. 344. *The Camel-thorn.* Vern. *Jawāsa, jewassi, jawā, jawān, jawāni.* (*Kas*, Sindh.)

A small, nearly glabrous shrub, extremities pubescent; armed with numerous axillary, spreading spines, ½-1 in. long. Leaves simple, short-petiolate, oblong, coriaceous. Flowers red, on short slender pedicels, 1-6 from the axillary spines. Pod about 1 in. long, straight or falcate.

Widely spread, from Greece and Egypt through Western Asia and Afghanistan to the plains of North-Western India; extending east as far as Monghir on the Ganges, and south to the Southern Mahratta country. Also in Guzerat and the Konkan. Generally found in dry barren places. Fl. March, April.; fr. ripens August.

Camels delight in it as fodder. In Guzerat, Sindh, and the Southern Panjab, screens (tatties) employed during the hot winds are made of it. Near Kandahar and Herat manna is found and collected on the bushes at flowering time, after the spring rains.

15. DESMODIUM, Desv.

Shrubs or herbs, with trifoliolate or unifoliolate stipellate leaves. Calyx campanulate or turbinate. Corolla exserted; standard broad; wings more or less adhering to the keel; upper stamen entirely or partially free; style incurved; stigma minute, capitate. Pod usually articulate, the articulations flat, 1-seeded, rarely splitting open at the upper suture.

Leaves 3-foliolate; bracts subulate . . . . . *D. tiliæfolium.*
Leaves 3-foliolate; bracts orbicular, foliaceous . . . *D. pulchellum.*
Leaves 1-foliolate, ovate, softly tomentose . . . *D. latifolium.*

1. **D. tiliæfolium**, Don.—Syn. *D. nutans*, Bot. Mag. t. 2867; *D. argenteum*, Wall. Vern. *Sambar, sammar, shamru, shambar, chamra, chamyār, chamkāt, chamkūl, martan, matta, marāra, gūr kats, gurshagal, prī, mūss, chīti must, kali must, mūrt, laber.*

A large, somewhat diffuse shrub, with trifoliolate leaves. Branchlets, inflorescence, pods, and leaves greyish tomentose or canescent. Leaflets broad-ovate or obovate from cuneate or rounded base, often mucronate, with 4-6 pair of prominent lateral nerves, green and glabrescent above, clothed beneath with a matted tomentum of whitish silky hairs, terminal leaflet largest, 2-5 in. long. Flowers red, on slender pedicels, longer than calyx, fasciculate, in spreading terminal panicles, with long drooping branches; bracts subulate, bractlets setaceous, at the base of calyx. Pods 2-3 in. long, ¼ in. broad; joints 6-10, somewhat longer than broad.

Common outer Himalaya from the Indus to Nepal, 3000-9000 ft. Fl. June-Sept. Bark fibrous, ropes are made of it which are strong but not durable. In Kullu and Kunawar, paper and pasteboard for the Buddhist monasteries in Tibet is made of the bark (H. Cleghorn). The branches are browsed by cattle.

2. **D. pulchellum**, Benth.—Syn. *Hedysarum pulchellum*, Linn.; Roxb. Fl. Ind. iii. 361; *Dicerma pulchellum*, DC.; W. & A. Prodr. 230; Wight Ic. t. 418.

An erect pubescent shrub. Leaves trifoliolate, leaflets ovate, obtuse, the terminal 4-5 in. long, more than twice the size of the lateral ones. Stipules subulate, with long bristly points. Flowers in terminal and axillary spiciform racemes, the flowers in the axils of 2-foliolate bracts, the common petiole terminating in a long bristle, the two lateral leaflets orbicular, enclosing the flower. Pod generally with 2 joints.

South India, Bengal, Burma, Oudh, and Gorakhpur, particularly in the Sāl forests. Fl. R.S.

3. **D. latifolium**, DC.; W. & A. Prodr. 223; Wight Ic. 270.—Syn. *Hedysarum latifolium*, Roxb. Fl. Ind. iii. 350.

A shrub with a short woody stem and spreading branches. Leaves unifoliolate, broad-ovate, 4-5 in. long, with an obtuse or cordate base, rough above, soft-tomentose beneath. Stipules semicordate, cuspidate. Flowers bright purple, in axillary and terminal racemes. Pods 4-5 jointed, hairy with stiff hooked hairs.

Bengal, Ceylon, Burma. Oudh forests. Kamaon. Fl. C.S.

This genus comprises numerous other shrubs and undershrubs within the range of this Flora, of which the following are the more common kinds:—Simple leaves have: 1. *D. triquetrum*, DC.; W. & A. Prodr. 224 (*Hedys. triq.*, Roxb. iii. 347); with broadly winged petioles. 2. *D. gangeticum*, DC.; Wight Ic. 271 (*Hedys. ganget.*, Roxb. iii. 349); with ovate, acute leaves. Trifoliolate leaves have: 3. *D. floribundum*, G. Don.—Syn. *D. multiflorum*, DC. *D. dubium*, Bot. Reg. t. 967; Bot. Mag. t. 2960. 4. *D. oxyphyllum*, DC., leaves and pods nearly glabrous; pods reticulate. 5. *D. concinnum*, DC. (*D. pendulum*, Wall. Pl. As. rar. t. 94), leaflets oblong, with marked lateral nerves, ascends to 7000 ft. in the North-West Himalaya. 6. *D. gyrans*, DC.; Wight Ic. t. 294 (*Hed. gyrans*, Roxb. iii. 351); lateral leaflets small, very sensitive, showing a rotatory motion during the day.

16. OUGEINIA, Benth.

Tree with trifoliolate leaves, and large stipellate leaflets, the 2 lateral opposite. Stipules free, deciduous. Flowers white or pale rose-coloured, on slender pedicels, 2 or 3 from one point, in short fasciculate racemes on the old wood. Bracts small, scaly; small persistent bractlets under the calyx. Calyx indistinctly 2-lipped, upper lip emarginate or bidentate. Standard nearly orbicular, short-clawed. Wings conform to and equal to the keel, slightly adhering to it. Stamens connate to beyond the middle, one quite free; anthers equal. Ovary sessile, with numerous ovules; style incurved, subulate; stigma capitate, terminal. Pod linear-oblong, flat, veined, contracted between the seeds, scarcely dehiscent. Seeds 2-5, flat.

1. **O. dalbergioides**, Benth.—**TAB. XXIII.**—Bedd. Fl. Sylv. t. 36.—Syn. *Dalbergia Oojeinensis*, Roxb. Fl. Ind. iii. 220; Wight Ic. t. 391. Sans. *Tinisa*. Vern. *Sannan*, *sāndan*, *chāndan*, Pb., N.W.P.; *Shānjan*, *pānan*, Oudh; *Tinsa*, *tinnas*, *tiwas*, *tewas*, *dhewas*, C.P.; *Ser-marra*, Gondi; *Tunnia*, Banswara; *Telus*, Khandeish Dangs.

Pubescent, terminal leaflet broad-oval, 2-6 in. long, lateral oblique-oval, 1½-3 in. long; edge undulate, shallow-crenate, 4-8 prominent main nerves on either side of midrib.

A common tree in Central and Northern India, as far as the Godavery on the east side and Canara on the west side of the Peninsula. In the outer Himalayan forests from the Great Gandak river to the Sutlej, ascending in the valleys to 4000, and in places to 5000 ft. The Jhelam appears to be its north-western limit, but it is scarce between that river and the Sutlej. Its southern and eastern limits require further inquiry. It is found in the Oudh, Gorakhpur, Godavery, and Canara forests. The old leaves are shed in Jan. and Feb., the new foliage comes out in April, May. The flowers appear before the leaves are fully out, from March-May.

A middle-sized tree, 20-40 ft. high, with a short, crooked, and often gnarled trunk, 3-5 ft., occasionally 7-8 ft. girth. Bark cinereous or dark brown, with long perpendicular and short cross-fissures, brittle corky scales peeling off.

Sapwood small, heartwood varies from light-greenish brown, with yellow tinge, to dark-red brown. It is close-grained, hard, the cub. ft. weighs 57-60 lb., Strong, tough, and durable; takes a beautiful polish. Much valued for agricultural implements, wheels, naves, furniture, also for building. Combs are carved of it.

An astringent red gum exudes from incisions in the bark. The bark is pounded and largely used to intoxicate fish. Twigs much lopped as cattle-fodder. In places difficult of access, tall and well-grown specimens are occasionally met with, but most older trees have been mutilated by lopping and stripping off the bark.

To the tribe of *Hedysareæ* belongs *Æschynomene aspera*, Linn.; Wight Ic. t. 299.—Syn. *Hedysarum lagenarium*, Roxb. Fl. Ind. iii. 365. Vern. *Sola*, *Phūl-Sola*. A large perennial water-plant, with thick stems mainly composed of light white pith, which is made into toys, floats, and Solah hats, invaluable as a protection against the sun. Abundant in tanks and marshes in Bengal.

Brya Ebenus, DC., Bot. Mag. t. 4670, the green or West Indian Ebony, a small tree with orange-coloured flowers, and dark green, nearly black heartwood, of Jamaica and Cuba, also belongs to this tribe.

17. **DALBERGIA**, Linn. fil.

Trees or climbers, with alternate, imparipinnate leaves, without stipels; leaflets alternate. Flowers small, white, lilac or purple, in dichotomous or irregularly branched panicles; bracts and bractlets small. Calyx 5-dentate, the lowest anterior tooth generally longer. Standard ovate or orbicular; wings oblong, as long as standard; keel obtuse, shorter than standard, its petals connate at the top. Stamens either diadelphous, the 10th stamen free, or monadelphous, with 9 or 10 stamens, or equally diadelphous, with 2 bundles of 5 stamens each, and the vagina slit below as well as above; anthers small, erect, didymous, the cells back to back, attached to the end of the filament, opening by diverging or divaricate slits, or with a short slit at the top. Ovary stipitate, with few ovules; style short, incurved, with a small terminal stigma. Legume like a samara, oblong or linear, flat, thin, indehiscent, with 1 or a few seeds. Seeds reniform, flat.

Trees or erect shrubs; stamens 9 or 10, monadelphous.
  Shrubs or small trees; panicles regularly dichotomous . . 1. *D. rimosa.*
  Large trees; panicles not dichotomous.
    Leaflets obtuse or emarginate; flowers pedicellate . . 2. *D. latifolia.*
    Leaflets acuminate; flowers sessile . . . . . . 3. *D. Sissoo.*
Trees; stamens 10, equally diadelphous.
  Leaves with reticulate venation, without prominent lateral nerves; petals and stamens inserted in the middle of the calyx-tube . . . . 4. *D. paniculata.*
  Leaves with prominent parallel lateral nerves; petals and stamens inserted at the base of calyx-tube.
    Leaflets 11-15; panicles lax; the 3 anterior calyx-teeth acute, the 2 posterior obtuse . . . . . . 5. *D. lanceolaria.*
    Leaflets 13-19; panicles compact; 4 calyx-teeth obtuse, the 5th longer and subacute . . . . 6. *D. hircina.*
Climbing shrubs; stamens 10, equally diadelphous . . . 7. *D. volubilis.*

Several valuable South American timber-trees belong to this genus. Of the principal varieties of *Rosewood* exported from Rio Janeiro, the two finest are supplied by species of *Dalbergia*, chiefly by *D. nigra*, classed in the same section as the Indian *Sissoo* and *Blackwood* (Bentham, Synopsis of Dalbergieæ, Linn. Soc. Jour. iv., Suppl. 5).

1. **D. rimosa**, Roxb. Fl. Ind. iii. 233; Wight Ic. t. 262.

A large shrub or small tree, glabrous. Leaflets 5-9, oval, 2-3 in. long, acute at both ends, with numerous, prominent, parallel nerves. Panicles terminal and axillary, lax, regularly dichotomous; flowers on short pedicels, small, less than $\frac{1}{8}$ in. long. Calyx supported by 2 obtuse bractlets, campanulate, all teeth obtuse, shorter than the tube. Claws of petals very short. Stamens 10, monadelphous. Ovary short-stipitate, ovules 1-2. Legume 2-3 in. long, 1 in. broad or less, 1-seeded.

Sikkim Terai, Assam, Kasia hills, and Silhet. Also in the Siwalik tract and outer Himalaya west to the Jumna, ascending to 4000 ft., J. L. S. Fl. March, April; seed ripens Nov., Dec.

2. **D. latifolia**, Roxb. Cor. Pl. t. 113; Fl. Ind. iii. 221; W. & A. Prodr. 264; Wight Ic. t. 1156; Bedd. Fl. Sylv. t. 24. The *Blackwood* or *Rosewood tree* of Southern India.—Vern. *Sitsāl*, Oudh; *Sāksāl, Sitsāl*, Mirzapore distr.; *Shīsham*, Banswara; *sirras, sirsa, sissa, sissu*, Mandla and Chindwara distr. of C.P.; *Biti*, Can.

A large glabrous tree, with dark-purple heartwood. Leaflets 3-7, generally 5, alternate, broad-obovate or orbicular, obtuse or emarginate. Flowers greenish or yellowish white, on slender pedicels as long or nearly as long as the calyx-tube, in axillary, branched, and divaricating panicles. Calyx-segments oblong or ovate, obtuse. Stamens 9, all united in a sheath, open on the upper side. Ovary glabrous, with 5 ovules; style slender, nearly as long as ovary; legume oblong-linear or oblong-lanceolate, 1-4-seeded.

Dry forests of South and Central India, frequently associated with Teak and Bamboo in South India, also in the evergreen forests (Bedd.), extending north to the Satpura range, Bandelkhand, and the Malwa plateau (Bassi in Meywar). Also in the Andamans, in lower Bengal, Behar, in Sikkim at the foot of the Himalaya, and (scarce and small) in the Baraitch and Gonda forests of Oudh, along the base of the hills. Old leaves are shed Feb., March, new leaves appear in April. The flowers appear with the young foliage, or before the old leaves fall; the pods ripen from Oct.-Feb.

In South India and the Godavery forests (Ahiri), a large tree 60-80 ft. high, with an erect, but not generally straight or regular trunk to 20 ft. girth. In North India a moderate-sized or small tree. Numerous thick branches, spreading into a large shady crown. Branchlets grey, bark of trunk $\frac{1}{2}$-1 in. thick, cinereous, less rough than the bark of Sissoo. Foliage fine glossy dark green. Coppices well, and propagates itself readily by self-sown seed. Easily raised from seed, but of slow growth, especially while young; 5-9 rings per in. of radius.

Sapwood large, whitish; heartwood with an irregular outline, from deep nut-brown to blackish purple, with white or purplish veins and streaks of lighter colour, and small whitish specks; fine-grained, strong, and heavy. The average weight of seasoned Blackwood fluctuates between 50 and 54.68 lb.; the lower figure is that given by Skinner, and the higher is the result of Baker's experiments made with Malabar wood. In the Central Provinces list, however, the weight is given at 66 lb. The average value of P. ranges between 722 and

1104, and may be taken at 950. Old trees are often hollow, and have ring-shakes. When fresh-sawn, the wood has an agreeable smell. Much valued for furniture. Combs and a great variety of ornaments are carved of it. Largely used for yokes, cart-wheels, ploughs and other agricultural implements, knee-timbers of boats, and for construction, also for spokes and fellies of gun-carriage wheels. In Oudh the tree is pollarded for cattle-fodder.

3. **D. Sissoo**, Roxb.—**Tab. XXIV.**—Fl. Ind. iii. 223; W. & A. Prodr. 264; Bedd. Fl. Sylv. t. 25. The *Sissoo tree.*—Sans. *Siusapa.* Vern. *Shīsham, sissu,* throughout North India; *Shewa,* Pushtu; *Tāli, sufedar, shīn, shīa, nelkar,* Pb.; *Sissāi,* Oudh.

A large tree with brown heartwood. Young parts pubescent or tomentose. Leaflets 3-5, alternate, broad-ovate, acuminate, glabrous when old. Flowers yellowish white, nearly sessile, in unilateral spikes, which are arranged in short axillary panicles; ramifications of inflorescence and calyx pilose. Stamens 9, all united into a sheath, open on the upper side. Ovary on a long stalk, pubescent; style very short, much shorter than the ovary; stigma large; legume linear-lanceolate, generally 2-3-seeded.

The Sissoo tree is indigenous in the sub-Himalayan tract, and in the outer Himalayan valleys, from the Indus to Assam, ascending to 3000, and at times to 5000 ft. Generally gregarious, mostly on sand or gravel along the banks of rivers or on islands, extending 50-100 miles into the plains. Believed to be indigenous also in Guzerat, Beluchistan, and Central India. I have never seen it really wild outside the sub-Himalayan belt. Cultivated and often self-sown throughout India; thrives best on light soil, and requires a considerable amount of moisture. The old leaves turn reddish brown, and begin to fall in December, but continue to be shed up to February, when the young foliage comes out, continuing until April. The full-grown foliage is of a fine clear green colour. Young trees are occasionally leafless for a few weeks; old trees are hardly ever without leaves. Fl. from March-June, at times with a second flush between July and October; the seed ripens from November-February, and generally remains long on the tree.

Under favourable circumstances a large tree, attaining 60 ft. and more, with an erect but not straight or regular trunk 6-12 ft. in girth; large branches supporting a spreading crown. Young shoots downy, bifarious, drooping; branchlets cinereous or light brown; bark of trunk ⅔-1 in. thick, grey or pale brown; narrow strips exfoliating between more recent obliquely longitudinal shallow fissures, and distant, older deep cracks, which tail off into each other.

Sapwood small, light-coloured; heartwood close-grained, brown, mottled with darker veins, in old trees sometimes very dark, nearly black. Medullary rays very fine. Pores large, scanty, uniformly distributed, often joined by narrow concentric bands of whitish tissue. A cub. ft. of seasoned heartwood weighs between 45 and 50 lb. Skinner gives it at 50, but this is too high as an average. The results of Baker's numerous experiments range between 42.68 and 46.25; the average of my experiments of 1864 was 47.83, and of 1865, 45.83. Instances are, however, recorded of a greater weight (55.5 lb., average of 3 experiments by Major Russell, Calcutta, 1862). Unseasoned wood weighs 64-70 lb. The transverse strength of Sissoo is probably somewhat less than of Blackwood, but considerably greater than of Teak, and even greater than of Sāl. Skinner gives the value of P. at 870; the average of 33 experiments made by me in 1864 was 739, and 51 experiments made in 1865 gave 865. Considering these, and the results of the numerous recorded experiments by Baker, Cunningham, and others, and excluding extremes, the mean value of P. will be found to range between 700 and 900. Sissoo is very elastic, it seasons well, does not warp or split, and takes a fine polish. It is durable in the Panjab and North-West India, less so in Bengal. Boats made of Sissoo on the Chenab will last 20 years.

Sissoo wood is esteemed highly for all purposes where strength and elasticity are required. It is used extensively in boat-building, for carts and carriages, agricultural implements, camel-saddle-frames, doors and window-frames, and in construction generally. It is an excellent and beautiful furniture-wood. At present the use of Sissoo wood is only limited by the insufficient supply. Until about 1820, considerable supplies of large Sissoo logs were regularly imported into Calcutta from the forests of the sub-Himalayan tracts of Nepal and adjoining districts. In those days Sissoo was the principal wood used for the construction of gun-carriages in Bengal; and it was only between 1820 and 1830 that Sissoo of large dimensions became scarce, and that Sāl timber began to be used extensively for this purpose, being more plentiful than Sissoo, though heavier, and not easily seasoned. The twigs and leaves are often lopped for cattle-fodder; camels prefer Sissoo to Kikar. The raspings of the wood are used in native medicine.

The Sissoo is easily raised from seed, grows rapidly with a long tap-root. The night frosts in the Panjab turn the leaves black, but do not kill the plants. The roots are bitter, and are not touched by white ants or rats. The Sissoo tree continues to grow rapidly until it attains maturity. In the Panjab it attains, under fair conditions, on an average 2½ ft. girth in 12, and 4½ ft. in 30 years. It coppices well, and in the Southern Panjab and Sindh it has always been raised from slips, often cuttings of thick branches. The slips are cut 1 ft. long, and are put in about the end of Feb., sometimes in March.

In the large plantations made since 1865 in the Panjab plains, the Sissoo is at present the most important tree. Its requirements and treatment are beginning to be well understood, and several thousand acres are now stocked with it. Here, as well as in its natural habitat, the Sissoo shows a decided preference for a light sandy soil. The tree is healthiest in the low Sailaba lands, which stretch along the main rivers, and are kept moist by percolation. On the bār or high ground between the rivers it thrives with the aid of canal irrigation when the soil is a sandy loam. On stiff binding soils the roots are small and the trees often unhealthy. On saline soils, and when there is a substratum of kankar, the Sissoo will not thrive. Regarding the eventual yield of these Sissoo plantations, and the production per acre, no definite estimate can yet be based upon the fragmentary data available. But so much is certain, that these plantations will yield large supplies of fuel and a proportion of timber, though it may appear doubtful whether so near its north-western limit the tree will attain dimensions at all approaching to those of the Sissoo in the more moist and forcing climate of the Nepal and Sikkim Terai, or in Bengal.

4. **D. paniculata**, Roxb. Cor. Pl. t. 114; Fl. Ind. iii. 227; W. & A. Prodr. 265.—Vern. *Katsirsa*, Oudh; *Dobein*, *dhobin*, *pāssi*, C.P.; *Padri*, Dharwar.

A large or moderate-sized tree, the wood in broad concentric masses, alternating with narrow layers of fibrous tissue. Young branchlets, petioles, and inflorescence hairy. Leaves turn black in drying; leaflets 9-13, generally 1 in. long, obovate, oblong or oval, glabrous, hairy beneath along midrib; venation reticulate; no prominent lateral nerves. Panicles terminal and axillary; flowers bluish white, nearly sessile, crowded on short unilateral racemes; bracts oblong, villose, early deciduous. Calyx campanulate, densely hairy outside, glabrous inside, all teeth acute. Claws of petals as long as calyx-tube. Standard from cordate base oblong, broader above, with straight sides, not thickened above the claw. Stamens 10, equally diadelphous; inserted with petals in the middle of calyx-tube. Ovary glabrous, ovules 2-3. Legume 1½-2½ in. long, ½-¾ in. broad, 1-2-seeded, narrowed at base and at top.

South and Central India. Gonda forests in Oudh. Siwalik tract west to the Jumna, ascending to 2500 ft. Leaves are shed Feb., March; the new foliage comes out in April and May, with the flowers.

A moderate-sized or large tree (60 ft. high in the Satpuras). Trunk erect, irregularly scooped out, fluted and compressed, attaining 5-6 ft. girth. Bark smooth, greenish white or cinereous. Wood greyish white, no heartwood. Structure most remarkable, entirely different from that of other Dalbergias. Broad concentric masses of wood alternate with narrow soft layers of a fibrous substance, so that planks cut of old trees often fall to pieces. The seasoned wood weighs 48, and the unseasoned wood 54 lb. per cub. ft. (R. Th.) Eventually this remarkable species may have to be placed in a distinct genus.

5. **D. lanceolaria,** L.—Syn. *D. frondosa*, Roxb. Fl. Ind. iii. 226; Wight Ic. t. 266; W. & A. Prodr. 266.—Vern. *Takoli*, *bithūa*, N.W.P.; *Barbat*, *parbāti*, Banswarra; *Gengri*, Panch Mehals; *Harrāni*, Dharwar.

A tree, glabrous, inflorescence covered with ferruginous pubescence. Leaflets 11-15, oval or oblong, obtuse, 1-2 in. long; lateral nerves numerous, parallel, joined by reticulate veins. Panicles large, lax, terminal and axillary; flowers ⅓-½ in. long, on short slender pedicels, in short unilateral racemes. Calyx broad-campanulate or turbinate, hairy outside, glabrous inside, the 2 upper teeth obtuse, the 3 lower teeth acute. Standard obovate, thickened above the claw. Stamens 10, equally diadelphous. Ovary long stipitate, generally hairy at the base, with 3 ovules. Legume 1½-4 in. long, ⅔-¾ in. broad, 1-3-seeded.

South India on the west side, as far as Banswara on the Mhye river, on the east side to Behar. Also in the Siwalik and outer Himalayan tract, extending west to the Jumna river, ascending to 2500 ft. Leafless for a short time, young foliage in March; fl. H.S.; seed Sept., Oct.

A middle-sized tree, attaining 30-40 ft., with a straight trunk 4-5 ft. girth. Bark thin, light or brownish grey. Wood white, without the peculiar concentric layers of *D. paniculata*. Small patches of black heartwood in the centre.

6. **D. hircina,** Ham.; Benth. Journ. Linn. Soc. iv. Suppl. 46.—Vern. *Sarao*, *bandūr*, *tantia*, *gogera*, N.W.P.

A small tree. Branchlets, petioles, and inflorescence clothed with dense ferruginous tomentum. Leaves 6-10 in. long. Leaflets 13-19, oval or oblong, obtuse, with adpressed hairs on both sides; lateral nerves numerous, parallel, joined by reticulate veins. Panicles short, axillary, compact. Flowers small, ¼ in. long, on slender pedicels, as long as calyx. Calyx campanulate, densely hairy outside, glabrous inside, 4 teeth obtuse, the 5th longer and subacute. Standard ovate, gradually narrowed into a claw, and thickened above it. Stamens 10, equally diadelphous, inserted with petals at the base of calyx-tube. Ovary stipitate, hairy. Legume straight, linear, 1½-2 in. long, ¼ in. broad, 1-4-seeded.

Siwalik tract and outer Himalaya, at 2500-5500 ft., from the Jumna to Nepal. Fl. Apr., May; the seed ripens in July.

7. **D. volubilis,** Roxb. Cor. Pl. t. 191; Fl. Ind. iii. 231; W. & A. Prodr. 265. Vern. *Bhatīa*, Kamaon; *Bankharra*, Oudh.

A large climber, glabrous, only petioles and ramifications of inflorescence pubescent. Leaves 4-6 in. long; leaflets 11-13, nearly opposite, oblong, generally broader at the top, obtuse, retuse, often mucronate, glabrous, with reticulate veins, no prominent lateral nerves. Inflorescence large, terminal, and axillary, drooping, composed of numerous compact, pedunculate, dichotomous panicles, which consist of short unilateral racemes, bracts oblong, deciduous after flowering. Flowers pale blue, ⅕ in. long; calyx short-pedicellate, tubular-campanulate, villous, the 2 upper teeth acute, the 3 lower obtuse. Claws of petals shorter than calyx-tube. Standard broad. Stamens 10, equally diadelphous. Ovary long-stipitate, with 2 ovules.

Sub-Himalayan tract. Kamaon to Sikkim, Oudh forests, Behar, the Central Provinces, Bandelkhand, and the Coromandel coast. Common in the Sāl forests of Oudh. Fl. Febr., March; seed May. A large climber with very tough wood.

18. PTEROCARPUS, L.

Trees with alternate, imparipinnate leaves; leaflets alternate, without stipels. Flowers large, yellow, in simple racemes or lax panicles. Calyx campanulate, with an acute base, generally curved, 5-dentate. Petals on long claws, those of the keel free, or slightly connate at the top. Stamens 10, monadelphous, the tube slit above, more or less divided into 2 bundles of 5 each, the 10th stamen frequently free; anthers versatile, cells parallel, opening longitudinally. Ovary with 2-6 ovules. Pod flat, orbicular or ovate, generally somewhat oblique, the seed-part in the middle. Seeds 1-3, separated by hard dissepiments.

1. **P. Marsupium,** Roxb. Cor. Pl. t. 116; Fl. Ind. iii. 234; W. & A. Prodr. 266; Bedd. Fl. Sylv. t. 21. Often called Bastard Teak.—Vern. *Bīja*, *bīja sāl*, *bījasār*, *bījhua*, *bia*, *bibla* (*Honay*, Canar.)

A large deciduous tree, with full foliage and dark-green shining leaves. Leaflets 5-7, coriaceous, elliptic, obtuse, emarginate or acuminate, with scattered adpressed hairs on both sides when young; glabrous, shining when full-grown; lateral nerves numerous, arcuate, joined by prominent reticulate veins. Flowers ½ in. long, on short pedicels, in short lateral and terminal paniculate racemes. Calyx, peduncles, and pedicels with scattered adpressed hairs. Stamens and petals inserted above the base of calyx. Claws shorter than petals, lamina of all petals broad, waved or curled. Stamens monadelphous, the tube divided deeply into 2 bundles. Ovary hairy. Pod angular, nearly orbicular, 1½-2 in diam.; style lateral.

Common formerly in South and Central India, though now in many places rare or nearly extirpated. On the west side found in the Santolah forests of Meywar, S.W. of Neemuch; on the east side as far as the Rajmahal and Mirzapur hills, near the Ganges; also in the extreme S.E. corner of Kamaon, ascending to 3000 ft.; not reported from the Oudh forests. Fl. May, June; the seed ripens Dec.-March.

Attains a considerable size, with an erect, but not very straight trunk 6-8 ft. girth. Yields beams 20 ft. long, and 20 in. square. In Central India large trees are now rare, save in the less accessible parts of the forests. (Maikal range and Delakhari Sāl forests.) Bark ½-⅔ in. thick, cinereous or dusky grey, rugose, with the outer softer corky layers flaking off. Inner bark reddish brown, fibrous. Sapwood large, whitish. Heartwood reddish brown or nut brown, close-grained, tough, and strong. In the green state the cub. ft. weighs 65-70 lb., seasoned between 51 and 56 lb. Skinner gives the value of P. at 868. The results of Puckle's experiments in Mysore range between 693 and 950. Seasons well, takes a fine polish, and is durable. The heartwood is full of gum-resin, and stains yellow when damp. Makes beautiful furniture, and is much used for doors and window-frames, posts and beams. Highly valued for cart and boat-building, for cotton gins and agricultural implements. In the peninsula it is considered, next to Teak and Blackwood, the most valuable tree, and the timber often fetches the same price as Teak. From wounds in the bark flows copiously a red gum-resin, true *Kino*, coll. in S. I., and exported. It is sold in little angular pieces, brittle, black and shining; melts in the mouth with a strong, simply astringent taste, like the kino of *Butea frondosa*, which it much resembles.

To the same genus belong: 2. *P. santalinus*, L. fil., the *red Sanders* wood of the North Arcot, Cuddapah, and Kurnool forests. Also found by Beddome in the Godavery forests, but not known further north, with 3 leaflets and smaller flowers; claws as long as the lamina of petals. 3. *P. indicus*, Willd., with 7-9 acuminate leaflets, the *Padouk* of Burma. The rosewood or lancewood of western tropical Africa is the produce of *P. erinaceus*, Poir.; Guill. et Perr. Fl. Seneg. t. 54.

19. **PONGAMIA**, Vent.

Trees with imparipinnate leaves, the leaflets opposite, without stipels. Calyx cup-shaped, truncate, or with 5 indistinct teeth. Standard broad-ovate, thickened at the base, with callous inflexed auricles at the top of the claw; keel obtuse, its petals cohering at the back near the top. Stamens 10, monadelphous, the tenth stamen free at the base, in the middle connate with the rest into a closed tube; anthers versatile. Ovary nearly sessile, with 2 ovules; style filiform, incurved, with a small terminal stigma. Legume oblong, indehiscent, 1-seeded, shell thick, coriaceous, the sutures obtuse, without wings. Seed reniform, thick, hilum small.

1. **P. glabra**, Vent.; W. & A. Prodr. 262; Wight Ic. t. 59; Bedd. Fl. Sylv. t. 177.—Syn. *Galedupa indica*, Lam.; Roxb. Fl. Ind. iii. 239.—Sans. *Karanjaka*. Vern. *Pāpar, pāpri, karanj, karanjh, kanji, kūnj*. Local n. *Sūkchein*, Pb.; *Charr*, Mairwara.

A moderate-sized tree, glabrous, almost evergreen, with bright-green shining leaves. Leaflets 2-3 pair, ovate or elliptic, short-acuminate, 3-5 in. long, with 4-6 lateral arcuate nerves on either side of midrib. Flowers mixed blue, white, and purple; petals dark-veined. Pod thick, hard, semi-ovate, about 2 in. long, 1 in. broad, acute at both ends.

Common near banks of streams and watercourses, and elsewhere in moist localities; often associated with *Terminalia Arjuna*, in South and Central India, Burma, and Bengal. Also at the foot of the Himalaya, and in the outer valleys extending west to the Ravi (not common), and ascending to 2000 ft. Outside India in Ceylon, Malacca, the Indian Archipelago, extending northward to South China, and eastward to the Fiji Islands, Timor, and tropical Australia. The leaves are shed in April, and are renewed soon afterwards. Fl. May, June; the pods ripen in April of the ensuing year.

Attains 50-60 ft; trunk short, not very regular, 5-8 ft. girth; crown spreading, shady. Bark smooth, striated, of a whitish or dusky cinereous colour, 1 in. thick. Inner bark yellowish, fibrous, with an unpleasant smell. Wood yellowish, with darker veins, hard, and tough; sap and heartwood not distinct. Used for building, but not durable, readily eaten by insects. In South India solid cart-wheels are made of it. The pods (*bara karanj*) and the leaves are used in native medicine, and oil is expressed from the seeds, used for burning, and medicinally (Pharm. Ind. 79).

20. DERRIS, Loureiro.

Climbing shrubs or trees, with alternate imparipinnate leaves; leaflets opposite, exstipellate. Flowers violet, purplish, or white, in simple or paniculate racemes. Calyx truncate. Standard unappendaged; wings obliquely oblong, slightly cohering to the keel-petals. Vexillary stamen united to the rest near the middle, rarely free; anthers versatile. Ovary 2 - ∞ - ovulate; stigma terminal. Legume indehiscent, oblong or orbicular, flat, membranous, or coriaceous, narrowly winged on the upper or both sutures. Seeds solitary or several, compressed.

1. **D. scandens**, Benth. in Linn. Journ. iv. Suppl. 103.—Syn. *Dalbergia scandens*, Roxb. Cor. Pl. t. 192; Fl. Ind. iii. 232; W. & A. Prodr. 264.

A large climbing shrub, with imparipinnate leaves. Leaflets 3-4 pair, elliptic-lanceolate, 2-3 in. long, glabrous, dark green, subcoriaceous, common petiole pubescent. Flowers on filiform pedicels, light rose-coloured, in long slender racemes. Pods flat, oblong, marginate, 2-3 in. long, 2-4-seeded.

Baraich and Gonda forests in Oudh, Bengal, South India, Ceylon, Burma, Indian Archipelago, North Australia, and South China. Fl. R.S.; fr. C.S., H.S. Attains 1 ft. in girth.

D. robusta, Benth. l. c. 104—Syn. *Dalbergia robusta*, Roxb.; Wight Ic. t. 244. *D. Krowei*, Roxb. Fl. Ind. iii. 229,—a tree, with narrow-linear pods 2-3 in. long, and ½ in. wide, of South India, Ceylon, Bengal, is found in Kamaon (Madden), ascending to 5000 ft. (vern. *Buro*).

SECOND SUB-ORDER, **CÆSALPINIEÆ.**

Trees, shrubs, rarely herbs, with pinnate, abruptly bipinnate, bifoliolate, rarely unifoliolate leaves; leaflets generally not stipellate. Flowers bisexual, generally irregular. Calyx of 5 more or less connate sepals. Petals 5, or fewer, imbricate in bud, the upper petal inside. Stamens 10, or fewer, rarely numerous, free, or more or less connate. Seeds with or without albumen; the embryo with a straight radicle.

Leaves bipinnate, common petiole long.	
Pod flat, thin, membranous, indehiscent, with a broad wing on the seminiferous suture	1. MEZONEURUM.
Pod thick or more or less turgid, not winged.	
Calyx imbricate, of 5 unequal sepals	2. CÆSALPINIA.
Calyx valvate, of 5 equal sepals	POINCIANA (p. 157).
Calyx valvate, of 4 sepals, the 2 upper connate	COLVILLEA (p. 157).
Leaves bipinnate, common petiole short, spinescent, leaflets minute	3. PARKINSONIA.
Leaves simple or bifoliolate.	
Calyx gamosepalous; seeds numerous	4. BAUHINIA.
Calyx of 5 nearly distinct sepals; pod 1-seeded	5. HARDWICKIA.
Leaves abruptly pinnate.	
Calyx-tube turbinate, segments 4; petals 3	6. TAMARINDUS.
Calyx-tube very short, segments 5; petals 5	7. CASSIA.
Calyx-tube long, funnel-shaped; petals none	8. SARACA.

1. **MEZONEURUM**, Desfontaines.

Climbing-shrubs with bipinnate leaves. Flowers in terminal or axillary, solitary or panicled racemes. Calyx oblique, with 5 broadly-imbricate segments, anterior segment larger, concave, outside in bud. Petals 5, rather unequal. Stamens 10, free; anthers uniform. Ovary with 2 or more ovules, stigma terminal, truncate, or dilated. Legume indehiscent, or nearly so, compressed, central suture longitudinally winged. Seeds compressed, exalbuminous.

1. **M. cucullatum**, W. & A. Prodr. 283.—Syn. *Cæsalpinia cucullata*, Roxb. Fl. Ind. ii. 358. Vern. *Biskoprah*, Oudh; *Ragi*, Bombay.

A powerful climber, branches and petioles armed with strong hooked prickles. Pinnæ 3-7 pair; leaflets 4-5 pair, coriaceous, shining, ovate, acuminate, 2-4 in. long. Flowers yellow in axillary and terminal panicles, composed of a few rigid racemes. Pods flat, shining, unarmed, foliaceous, 3-4 in. long, 1 in. broad, with a broad membranous wing on the seminiferous suture. Seeds 1-2.

Bengal, Oudh forests, Konkan, Western Ghats. Indian Archipelago. Fl. Nov.-Feb. Fr. ripe March.

2. **CÆSALPINIA**, Linn.

Trees or shrubs, often climbing, and armed with prickles. Leaves bipinnate. Flowers white, yellow, or red, in simple or panicled racemes. Calyx-lobes 5, imbricate, the lower outside and often larger. Petals 5, orbicular or obovate, nearly equal. Stamens 10, free; anthers uniform, dehiscing longitudinally. Ovary free, inserted at the base of the short calyx-tube; ovules few. Pod compressed, coriaceous, indehiscent, or 2-valved. Seeds in some species separated by cellular partitions, generally exalbuminous, with a short straight radicle.

Pods covered with closely-set prickles; a prickly climber	1. *C. Bonducella.*
Pods smooth, without prickles.	
A prickly climber; pubescent; flowers in lateral racemes	2. *C. sepiaria.*
An erect, almost unarmed shrub; glabrous; flowers in terminal corymbs	3. *C. pulcherrima.*

1. **C. Bonducella**, Roxb. Fl. Ind. ii. 357.—Syn. *Guilandina Bonducella*, Linn. *The fever-nut.* Vern. *Katkaranj*, *kat karinga*, *karanjo*, *karanja*, *karonj*. (*Karbat*, *kachka*, Sindh.)

A scandent shrub; pubescent; branches, petioles, inflorescence armed, sparsely or densely, with short, unequal, slightly recurved prickles. Leaves ample, 1-1½ ft. long, pinnæ 6-8 pair; leaflets opposite, 6-10 pair, elliptical with a rounded, somewhat unequal-sided base, apex mucronate. Stipules large, cut into large segments. Racemes axillary, many-flowered, simple or branched below, bracts linear-lanceolate, with a spreading or recurved apex, projecting beyond the unopened flowers. Calyx rusty-tomentose, with recurved lobes, the inferior lobe largest, hood-shaped. Petals yellow, spreading, the upper sometimes spotted with red. Pods 2-valved, 2-3 in. long, 1½-1¾ in. broad, coriaceous, covered with sharp, straight, spreading prickles. Seeds 1-2, globose or ovoid, smooth, shining, bluish grey or lead-coloured, ¾ in. long.

Widely spread throughout the tropics, indigenous or naturalised in Southern, Eastern, and a great part of North-Western India, ascends to 2500 ft. in Kamaon. In the Panjab only cultivated, and occasionally run wild in hedges and waste places. Common in the Salt line fence in Harriāna. The large yellow flowers appear in the rains. Is an excellent hedge-plant. The seeds contain a fixed oil, resin, and a bitter substance: they are tonic and antiperiodic (Pharm. Ind. 68).

C. Bonduc, Roxb. (*Guilandina B.*, Linn.), a nearly allied species in South India and Burma, has nearly glabrous leaves, no stipules, and erect bracts. In W. & A. Prodr. 280, the two are united, under the name of *G. Bonduc.*

2. **C. sepiaria**, Roxb. Fl. Ind. ii. 360; W. & A. Prodr. 282; Wight Ic. t. 37. *Mysore thorn.*—Vern. *Urn*, *ūri*, *ūran*, *arlu*, *kando*, *relu*, *relmi*, Pb.; *Kingri*, *aira*, *karaunj*, *agla*, *kārkari*, *kannena*, Garhwal, Kamaon; *Aūla*, Oudh; *Senseni*, Chittor in Meywar; *Chillar*, Bombay.

A large, prickly climber. Pubescent; branches, petioles, and peduncles armed with short, strong, recurved prickles. Leaves ample, 10-18 in. long, pinnæ 6-10 pair; leaflets opposite, 8-12 pair, oblong, obtuse, on short petioles; stipules semisagittate, deciduous. Flowers yellow, in simple axillary racemes, pedicels longer than flowers, jointed at the top, bracts lanceolate, clothed, as well as pedicels and calyx, with ferruginous tomentum. Lobes of calyx oblong, broader above, a little shorter than the petals, the inferior lobe hood-shaped, larger than the others. Stamens somewhat longer than petals, villous below. Pod glabrous, oblong, obliquely cuspidate, 2-3 in. long, 1 in. broad. Seeds 4-8, ovoid, mottled, brown and black, less than ½ in. long.

Indigenous and naturalised throughout India and Burma. Outer hills of the Himalaya, extending to the Indus, ascending in places to 6000 ft. Said by Roxburgh to have been introduced into Bengal from Mysore by General Martin. Fl. Feb.-May; Aug. (Hazara.) Makes an almost impenetrable fence: Hyder Ali planted it round fortified places.

Nearly allied is *the Sappan-wood*, *C. Sappan*, Linn.; Roxb. Cor. Pl. t. 16; Fl. Ind. ii. 357. Vern. *Patang*, *Bakam*, a large prickly tree in South India, Burma, and Bengal, with yellow flowers in large terminal panicles, unequal-sided leaflets, and thick, woody, smooth, shining, dark-brown pods, broader at top, obliquely truncate and mucronate. The wood, which yields a valuable dye, is largely exported from Calcutta, Madras, Ceylon, and Siam.

C. Nuga, Ait.—Syn. *C. paniculata*, Roxb. l. c. 364; Wight Ic. t. 36, Bengal, Indian Archipelago,—is a prickly climber, with short rhomboid, cuspidate, 1-seeded pods.

3. **C. pulcherrima**, Sw.—Syn. *Poinciana pulcherrima*, Linn.; Roxb. Fl. Ind. ii. 355; W. & A. Prodr. 282. Vern. *Krishna-chūra*, Beng.

A large shrub. Glabrous, armed with a few scattered prickles. Pinnæ 3-9 pair, leaflets 5-10 pair, obovate-oblong, obtuse or emarginate. Flowers large, orange or bright yellow, on long pedicels, more than twice the length of flowers, supported by early caducous, subulate bracts, in terminal pyramidal racemes. Calyx-tube turbinate, segments oblong, the inferior segment larger, hood-shaped. Petals ½-1 in. long, narrowed into a claw, edge often lacerate. Style and stamens much longer than corolla; filaments slightly hairy below, stigma minute. Legume linear-oblong, flat, obliquely rounded at the top.

Cultivated in gardens in most parts of India. Said originally to have been brought from the Moluccas. In the West Indies it is either indigenous, or naturalised at a very early date (Macf. Fl. Jam. 331).

C. coriaria, Willd., the *Divi-divi* or *Libi-dibi*, is a spreading tree 20-30 ft. high, indigenous in the West Indies and Central America, unarmed, glabrous, with bipinnate leaves, pinnæ unpaired, leaflets linear; flowers white, scented, in short compound racemes, and broad, oblong, glabrous, twisted pods. The pods are rich in tannin. The tree has been introduced into Western and South India, and its cultivation deserves to be extended, as it yields valuable material for tanning. X

Three splendid ornamental, soft-wooded trees, nearly related to *Cæsalpinia*, are largely cultivated in India. 1. *Poinciana regia*, Bojer, Bot. Mag. t. 2884, a native of Madagascar, introduced into India within the last 60 years, and commonly grown in gardens north-west as far as the Jumna, with 8-20 pair of pinnæ, large bright-scarlet flowers, in terminal and axillary racemes; petals 2-3 times longer than calyx-lobes, 2 in. long, almost orbicular, tapering into claws 1 in. long, the upper petal more cuneate, variegated and striated with red and yellow; stamens nearly as long as petals. Pods 2 in. broad, 20-24 in. long. 2. *P. elata*, Linn., Bedd. Fl. Sylv. t. 178, indigenous in forests of the western and eastern coasts of the Peninsula, as far north as Guzerat, common near towns and villages in Marwar (Madden), and cultivated largely in South India, with yellowish flowers in lax corymbs, terminal or from the upper axils, petals somewhat longer than calyx, 1 in. long, on short claws, with a rounded lamina, much curled on the margin, stamens much exceeding petals, 2-4 in. long. 3. *Colvillea racemosa*, Bojer, Bot. Mag. t. 3325, 3326, with large leaves, pinnæ 20-30 pairs, bright-scarlet flowers in erect, compact, cylindrical racemes, 18 in. long, terminal and from the upper axils, petals as long as calyx, unequal, the upper and inside petal orbicular, convolute, the 2 lateral petals longer, cuneate, the 2 upper longest, falcate. This tree was discovered on the western coast of Madagascar by Professor Bojer in 1824, brought by him to the Mauritius, and introduced into India about 1840. Generically, these 2 genera differ from *Cæsalpinia* by a valvate calyx, consisting in *Poinciana* of 5 equal segments, while *Colvillea* has 4, of which the 2 uppermost are connate nearly to the top.

3. **PARKINSONIA**, Linn.

Spiny shrubs, or small trees, with bipinnate leaves; primary petioles short, secondary elongated, abruptly pinnate, with minute leaflets. Flowers yellow, in lax axillary racemes. Calyx divided nearly to base into 5 equal, membranous, slightly imbricate segments. Petals 5, equal, spreading. Stamens 10, free; filaments pilose at base; anthers uniform, elliptical. Ovary 8-15-ovulate, style filiform, recurved in bud. Pod linear, contracted between the seeds, seeds albuminous.

1. **P. aculeata**, Linn.; W. & A. Prodr. 283.—Vern. *Vilayati kikar*, Pb.

Common (primary) petiole ½ in. long, ending in a stout sharp spine, often with lateral stipulary spines. Pinnæ 6-10 in. long, 2-4 on either side, clustered, flat, coriaceous, with or without minute leaflets. Racemes shorter than leaves, pods 3-6 in. long.

Indigenous in the West Indies and tropical America, cultivated in most tropical countries, almost naturalised in India, where it is grown as a hedge-plant. Has spread largely throughout the Panjab since annexation, and thrives well in the more arid districts. Common in the Salt line fence in Harriāna. Fl. throughout the year. Branches lopped as fodder for goats. Wood whitish, light and soft, but close-grained, polishes fairly.

To the same tribe as the preceding genera (*Eucæsalpinieæ*) belongs *Hæmatoxylon campechianum*, Linn., the logwood, a most valuable dyewood of Central America and the West Indies; also *Acrocarpus fraxinifolius*, Arnott, Bedd. Fl. Sylv. t. 44, one of the largest timber-trees of the evergreen forests along the Western Ghats.

4. **BAUHINIA**, Linn.

Trees, shrubs, or climbers, with simple or bifoliolate leaves, the leaflets distinct, or more or less connate. Flowers white, pink, or purple, in simple or paniculate racemes. Calyx gamosepalous, turbinate or tubular, cleft into 5 segments, or split on the upper side, and spathaceous. Petals 5, spreading, slightly unequal. Stamens 10, all or only a portion perfect, free or more or less connate; anthers versatile, the cells dehiscing longitudinally. Ovary stipitate, stalk free or adnate to the tube, with 2 or numerous ovules. Pod indehiscent or 2-valved, long, linear, or oblong. Seeds numerous.

Stamens 10, all perfect; ovary-stalk free; pod indehiscent (sub-genus *Pileostigma*).
  A tree; calyx 5-cleft; legume marked with regular parallel reticulate veins . . . . 1. *B. malabarica.*
  A tree; calyx spathaceous; legume irregularly reticulate . 2. *B. racemosa.*
Perfect stamens 3, 4, or 5; ovary-stalk adnate to calyx; pod 2-valved (sub-genus *Phanera*).
  Trees; flowers large, in short racemes.
    Perfect stamens 3; calyx 2-cleft to the base; leaflets connate to the middle . . . . 3. *B. purpurea.*
    Perfect stamens 5; calyx spathaceous; leaflets connate beyond the middle . . . . 4. *B. variegata.*
  A tree; flowers small, in large panicles; perfect stamens 3; calyx 2-3 cleft to the base; leaflets connate to the apex . 5. *B. retusa.*
  A climber; flowers middle-sized in large corymbs . . . 6. *B. Vahlii.*

Of the sub-genus *Pauletia*, with large flowers, a spathaceous calyx, the ovary-stalk free, 10 perfect stamens, and a narrow linear pod, there are two species, which will probably be found in the range of this Flora. 1. *B. acuminata*, Linn.; Roxb. Fl. Ind. ii. 324; W. & A. Prodr. 295. Vern. *Kachnār*. A large erect shrub, with greyish-brown bark. Leaves 2-lobed nearly to the middle, each lobe (leaflet) with 4 penniveined nerves; lobes ovate, pointed. Flowers white, 2 in. across; calyx tapering into a long fine apex, divided into 5 hairy, filiform teeth. Pod flat, 3-4 in. long, ½ in. broad, upper suture thickened and 3-keeled. Bengal, South India, Burma. 2. *B. tomentosa*, Linn.; Roxb. Fl. Ind. ii. 322; W. & A. Prodr. 295. A shrub, with ash-coloured bark. Branchlets, petioles, and under side of leaves with rust-coloured pubescence. Leaves 2-lobed to the middle, lobes obtuse, 3-nerved. Stipules subulate, ⅓ in. long. Flowers white or pale yellow, 4 in. across. Pods flat, tomentose, 4-5 in. long, ½ in. broad. South India, Indian Archipelago.

1. **B. malabarica**, Roxb. Fl. Ind. ii. 321; W. & A. Prodr. 294.—Vern. *Amlōsa*, Oudh; *Amli*, N.W.P.; *Boayyyin*, Burm.

A tree, nearly glabrous; inflorescence, calyx, petioles, and nerves on the underside of leaves with rusty pubescence. Leaves cordate at base, broader than long, leaflets united beyond the middle, each with 4-5 nerves. Racemes axillary, often 2 or 3 together, short, nearly sessile; bracts triangular, ciliate, deciduous. Flowers ½ in. long, pedicels slender, longer than calyx, calyx funnel-shaped, teeth 5, equal, triangular. Petals spathulate, equal. Stamens 10, all fertile, slightly monadelphous at the base. Legume linear, 12 in. long, ⅝ in. broad, long-acuminate, on a stalk 1 in. long or longer, marked with regular parallel, waved, and reticulate veins, generally descending from the edges to the middle of the valves.

Sub-Himalayan forests from the Ganges to Assam, frequently associated with Sāl. Oudh Sāl forests, but not plentiful. Also in Behar, the Godavery forests, Mysore, along the western coast, and in Burma. Fl. Oct., Nov.; fruit April, May. In Oudh attains 30 ft., and a girth of 4-5 ft. In Burma and Malabar it is a large tree. Foliage dark green. Heartwood small, dark brown, weight 42 lb. per cub. ft. in Burma. The leaves are acid, and are eaten.

2. **B. racemosa**, Lam.; W. & A. Prodr. 295; Bedd. Fl. Sylv. t. 182. —Syn. *B. parviflora*, Vahl.; Roxb. Fl. Ind. ii. 323. Vern. *Kosūndra*, *taur*, Pb.; *Kachnāl*, *gūriāl*, *thaur*, N.W.P.; *Ashta*, *makkūna*, Oudh; *Mahauli*, Banda; *Maula*, *ashto*, *dhorāra*, C.P.; *Dhondri mara*, Gondi; *Hpalanben*, Burm.

A small tree, pubescent, or rusty-tomentose. Leaves cordate at base, broader than long; leaflets united beyond the middle, with 4 nerves each. Racemes terminal or opposite to leaves, lax, 3-6 in. long; flowers distant, whitish yellow, ½ in. long; pedicels shorter than calyx. Bud curved, unequal-sided. Bracts subulate, tomentose, deciduous. Calyx spathaceous, at length reflexed, 5-toothed. Petals linear-lanceolate, stamens 10, all fertile and united at the base. Legume linear, thick, generally curved, 4-12 in. long, 1 in. broad; valves marked with irregularly reticulate lines.

Dry forests of South and Central India, Burma, Bengal, Oudh. Sub-Himalayan tract to the Ravi, ascending to 5000 ft. in Kamaon. Old leaves are shed in Dec., or later; the new foliage appears between March and June. Fl. March-June; the pods ripen Nov.-March.

A small, crooked, bushy tree, 15-20 ft. high, branchlets drooping. Bark 1 in. thick, rough, with exfoliating quadrangular scales, dark grey or brown. Inner bark bright red, fibrous. Wood reddish brown, heart small, irregularly shaped, of a darker colour. R. Thompson makes the weight of the seasoned wood (C. Prov.) 56 lb. per cub. ft. Rope, strong and durable, is made from the inner fibrous bark; also slow-matches for matchlock-men.

3. **B. purpurea**, Linn.; Roxb. Fl. Ind. ii. 320; W. & A. Prodr. 296. —Sans. *Kharvallika*. Vern.* *Kolār, karār, karālli*, Pb.; *Koliār, kaniār, kandan, khairwāl*, N.W.P.; *Kwillar*, Oudh; *Kodwari*, Gonds, C.P.

A tree. Nearly glabrous; young branches, inflorescence, and calyx covered with brown pubescence. Leaves coriaceous, cordate at base, as long as broad; leaflets united to the middle, or a little beyond, 4-5-nerved, the inner edges often overlapping. Racemes paniculate. Flowers of a deep rose-colour, pedicels in the axils of triangular bracts, with a pair of subulate bracteoles in the middle. Calyx cleft to the base of the limb into 2 reflexed segments, the one emarginate, the other 3-toothed, sometimes cohering at the apex. Petals oblong-lanceolate, narrowed at the base, 1-2 in. long. Fertile stamens 3, occasionally 4, long, ascending. Ovary hairy, stalk cohering on one side with calyx-tube. Legume 6-12 in. long, linear, flat, pointed. *B. triandra*, Roxb., with white flowers, is probably a variety of *B. purpurea*.

Wild in dry forests of most parts of India, as far west as the Indus, ascending to 4000, and at times to 5000 ft., also in Burma. Often associated with *Sāl* and *Bamboo* (*Dendrocalamus strictus*). Cultivated throughout India. Particularly fine in the Kotree Doon and the Patlee Doon, and their side valleys; also in the Sāl forests of the Meikla range, C. Prov. In North-West India fl. from Sept.-Nov. Pods ripen Jan.-April.

A moderate-sized tree, to 40 ft. high, with a short trunk attaining a girth of 6-9 ft. Bark ½ in. thick, smooth, or rough, with rounded exfoliating scales, whitish, ash-coloured, or dark brown. Heartwood of a handsome yellowish or reddish brown colour, hard, close-grained, durable. Sapwood liable to be attacked by insects. Employed for agricultural implements, and in construction when found sufficiently large. The cub. ft. of seasoned wood weighs 39 lb., of green wood, 45-48 lb.; value of P. 567 (Skinner).

The bark is used for tanning, the leaves are lopped for cattle-fodder, the flower-buds are pickled and eaten as a vegetable.

4. **B. variegata**, Linn.; Roxb. Fl. Ind. ii. 319; W. & A. Prodr. 296. —Sans. *Kovidāra, kānchanāra*. Vern. *Kachnār*, North and Central India; *Koliār, kurāl, karal, padriān*, Pb.; *Khwairal, gūriāl, gwiar, bariāl*, N.W.P.

A tree, young branches, under side of leaves, inflorescence, and calyx with short pubescence. Leaves with cordate or rounded base, as broad as long; leaflets connate beyond the middle, with 5-7 nerves. Racemes short, axillary or terminal, with few flowers. Bracts small, broad, triangular. Flowers large, 2 in. long, fragrant. Calyx spathaceous, ovate, 5-toothed at the apex. Petals oblong, the fifth broader, ovate or obovate. Perfect stamens 5. Ovary-stalk cohering with the calyx-tube. Legume 6-18 in. long, linear, flat. Two varieties: one with red flowers, 4 petals light purple, the 5th deep purple, tinged with cream and red; the other with white flowers, *B. candida*, Roxb. l. c. 318, 4 petals white, the 5th variegated inside with yellowish green.

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* The vernacular names of *B. purpurea* and *variegata* demand further inquiry.

Wild in most wooded parts of India, as far west as the Indus, also in Burma. Abundant in the warm glens between the Kosilla and Sarda (Madden). Cultivated throughout India. Fl. Feb.-April; old leaves are generally shed before flowers appear; young foliage in April and May.

A moderate-sized tree, with a short erect trunk, attaining 4-5 ft. girth. Bark light or dark grey, with vertical cracks. Wood light or reddish brown, weight 54 lb. per cub. ft. (seasoned), 67⅜ lb. (green), R. Th., considered less durable than that of *B. purpurea*, much used for agricultural implements. Bark astringent, used for tanning and dyeing. Leaves and flower-buds eaten as vegetables; flower-buds are often pickled.

5. **B. retusa**, Roxb. Fl. Ind. ii. 322.—Syn. *B. emarginata*, Royle. Vern. *Kurāl*, Pb.; *Kandla, kanalla*, Kamaon.

A small tree, glabrous, only extremities of inflorescence and calyx with short whitish pubescence. Leaves entire, or emarginate, broad-ovate with a cordate or straight base, broader than long, with 9-11 nerves, branching above the middle. Flowers numerous, pale yellow, ½ in. across, on long slender pedicels in corymbose, pedunculate racemes, forming large terminal panicles. Calyx ovate, split into 2 or 3 segments. Petals clawed, hairy outside, lamina orbicular, beautifully marked with dark purple veins. Perfect stamens 3, ovary hairy below, curved, the stalk adnate to the calyx-tube. Legume oblong, 4-6 in. long, 1 in. broad, often broader at the top.

Siwalik tract and outer N.W. Himalaya, ascending to 4500 ft., west to the Bias. Oudh, and occasionally in the Central Provinces. Chiefly in damp places. Fl. Sept. A small tree with a short trunk 3 ft. girth, spreading branches, and long, slender, waving, pendulous branchlets. Bark smooth, cinereous. Wood reddish. A brown insipid gum exudes from the bark, and is collected in the Dehra Doon.

6. **B. Vahlii**, W. & A. Prodr. 297.—Syn. *B. racemosa*, Vahl; Roxb. Fl. Ind. ii. 325. Vern. *Marwār, taur*, Pb.; *Malghan, māljan, mālu*, N.W.P.; *Maurain, jallaur*, Oudh; *Sihār, maul*, C.P.

A gigantic climber, clothed with dense grey or ferruginous tomentum, branchlets frequently terminating in a pair of opposite, revolute tendrils. Leaves very large, often 12 in. across, deep-cordate, as broad as long; leaflets connate to the middle, each with 5-7 prominent arcuate, penniveined nerves. Stipules obtuse, falcate. Flowers ¾ in. broad, on long slender pedicels, in terminal corymbose racemes. Bracts subulate, bractlets 2, above the middle of pedicel. Calyx-limb ovate, splitting to the top of the tube in two reflexed segments. Petals clawed, obovate, hairy outside. Perfect stamens 3. Ovary oblong, hairy, stalk adnate to calyx-tube. Legume pendulous, flat, thick, 6-18 in. long, 2-3 in. broad, woody, clothed with thick dark-brown tomentum. Seeds orbicular, flat, smooth, brown, 1 in. diam.

Common in the forests of Northern and Central India, in the sub-Himalayan tract from the Chenab to Assam, Behar, and on the western coast. Fl. April; the pods of the previous year ripen about the same time.

Stem irregularly ridged and furrowed, often more than 100 ft. long, with a fibrous bark and porous wood, in broad, irregularly concentric layers. Foliage dense, with an almost impenetrable network of branchlets, covering the largest trees, smothering them, or causing their stems to grow crooked and irregular, One of the greatest enemies of the Sāl tree, but nearly extirpated by the labours of the forest officers in the Khyregarh forests of Oudh. Rope is made from the bark; the leaves are used for packing, as plates, and umbrellas are made of them. The pod (*chihār*) is roasted, and the seeds are eaten.

5. **HARDWICKIA,** Roxb.

Trees, with abruptly pinnate leaves and small flowers in racemose panicles. Calyx of 5 distinct, ovate or orbicular, petaloid, imbricate sepals. Petals none. Stamens 10, alternately shorter, generally all fertile. Anthers versatile, dehiscing longitudinally. Ovary sessile, free, with 2 ovules.

1. **H. binata,** Roxb. Cor. Pl. t. 209; Fl. Ind. ii. 423; W. & A. Prodr. 284; Bedd. Fl. Sylv. t. 26.—Vern. *Parsid,* Singrowlie hills; *Anjan,* C.P.; *Acha,* Tam.

Glabrous. Leaves bifoliolate; leaflets sessile, entire, obtuse, obliquely ovate, or semicordate, with 4-5 arcuate nerves; common petioles ¼ or ⅓ the length of leaflets. Stipules small, cordate, caducous. Flowers greenish yellow, on long slender racemes, arranged in axillary or terminal panicles; pedicels shorter than flowers; bracts minute, caducous. Ovary oblong; style ascending, with a large, peltate stigma. Legume lanceolate, 2-3 in. long, with parallel longitudinal veins, a solitary seed near the top.

In dry forests of South and Central India, but not everywhere; generally gregarious in belts or patches of greater or less extent. It is wanting in the moister forests below and above Ghat on the west side of the Peninsula. In Central India, the tree is known in Chanda, Berar, Khandeish, and Nimar, on the eastern slopes of the Pachmarhis, near the Dhūdi river, and on the Singrowlie hills, south of the Soane river. Seed ripe April, May.

An elegant tree, attaining 50-60, occasionally 120 ft., with a tall, straight, and regularly shaped stem, and a narrow oval crown. Bark black, rough, with exfoliating scales. Young leaves tinged with red; mature foliage dark green; branchlets slender, drooping. Easily raised from seed, and throws up strong shoots from stumps.

Sapwood small, whitish; heartwood dark reddish brown, sometimes nearly black, close- and fine-grained, strong, very hard and very heavy, weight 67-85 lb. per cub. ft., 100-120 lb. when green; value of P. 942 (Skinner). Liable to split, but does not warp, takes a fine polish, and is exceedingly durable. Used for bridge- and house-posts, and for ornamental work.

The bark yields a valuable fibre, which requires no preparation, is strong, and is in places much used for cordage. Cattle are exceedingly fond of the leaves. In the Cauvery forests, Northern Mysore, and Berar, the trees were formerly, and are still to a great extent, pollarded for cattle-fodder.

6. **TAMARINDUS,** Linn.

An unarmed tree, with abruptly pinnate leaves, small caducous stipules and racemose flowers. Calyx with a turbinate tube, and 4 imbricate, membranous segments. Petals 3, the lateral ones ovate, the upper inner one narrower, concave. Stamens 3, perfect, incurved, united in a sheath to the middle, with oblong versatile anthers, dehiscing longitudinally, a few short filiform staminodes at the edge of the sheath. Ovary stipitate, the stalk adnate to the calyx-tube, with numerous ovules; a thick style and clavate stigma. Pod oblong, curved or nearly straight, thick, outer pericarp a thin crustaceous shell, inner layer an acid pulp, traversed by fibres. Seeds obovate or roundish, often angular, compressed, with a brown, very hard, thick, shining testa and no albumen.

1. **T. indica,** Linn.; Roxb. Fl. Ind. iii. 215; W. & A. Prodr. 285; Bedd. Fl. Sylv. t. 184. *The Tamarind.*—Sans. *Chukra, chincha.* Vern. *Amli, ambli, imli,* Hind.; *Chintz,* Konkan; *Magyiben,* Burm.

Leaves 3-6 in. long, leaflets 10-15 pair, linear-oblong, glabrous, obtuse, with fine reticulate venation, and more or less distinct intramarginal nerves. Racemes loose, with 10-15 flowers, at the end of short lateral branchlets. Petals unilateral, beautifully variegated with red and yellow. Pod pendulous, 3-8 in. long, 1 in. broad.

Cultivated throughout India and Burma, save in the North-Western Panjab; trees are found as far as the Jhelam, but the fruit does not ripen west of Amballa. In the Central Provinces, the Bassi forests Meywar, and in many parts of South India, the tree is found self-sown in waste and forest lands, but there seems no sufficient evidence of its being originally indigenous in India. Wherever I have seen it, it has been in the vicinity of existing or abandoned cultivation. The tree is cultivated in the tropics of both the New and Old World, and is believed to be truly indigenous in tropical Africa (Oliver Fl. Trop. Afr. ii. 308). Never leafless, the foliage changes in March and April; fl. May, June; fruit ripens 7-9 months after flowering.

A large tree, attaining 80 ft. or more, with a short thick trunk (25 ft. girth not rare), often ridged, with a magnificent broad and high, shady crown. Bark ½ in. thick, dark grey, brownish to blackish, tesselated by longitudinal fissures and cross-cracks. Wood yellowish white, hard and close-grained, the outer and younger wood a little softer, but the sapwood not defined by a concentric line, such as we find it in the wood of Teak, Sissoo, Sāl, Bija sal, Oak, and other trees. Heartwood small near the centre, outline very irregular, dark purplish brown, projecting into the yellowish outer wood with radiating ramifications, so that planks frequently show alternate layers of light- and dark-coloured wood. Annual rings indistinct, medullary rays very numerous, very fine, pores moderate, equal, uniformly distributed, each pore or group of pores surrounded by lighter-coloured tissue. Weight of outer wood (sap) 60 lb. (Cunningham); of the dark-coloured heartwood from 79-83 lb. Value of P. 605-623 (sapwood), 850 (heartwood). Polishes well, and though extremely hard and difficult to work, is prized highly for many purposes when a tree past fruit-bearing is felled. Naves and other parts of wheels, mallets, planes, tent-pegs, furniture, rice-pestles, oil-presses, and sugar-crushers are made of it; it is an excellent wood for turning. The heartwood is very durable, the outer wood is apt to be eaten by insects.

Mainly cultivated on account of the acid pulp of the pod; there are several kinds, with sour, sweetish, and red pulp. The pulp contains Citric, Malic, and Tartaric acids; large quantities are imported into England from the West Indies. It is officinal as a laxative and refrigerant (Pharm. Ind. 64). The seeds (*chincha*) are used in native medicine; pounded, they are eaten in times of scarcity, and the powder mixed with gum makes cement.

7. CASSIA, Linn.

Trees, shrubs, or herbs, with abruptly pinnate leaves and yellow or red flowers. Calyx-tube very short, segments 5, imbricate in bud. Petals 5, nearly equal, imbricate. Stamens 10, all perfect, or a portion (3 or 5) more or less abortive. Legumes indehiscent or 2-valved. Seeds albuminous.

A tree, leaves without interpetiolar glands; pods long, cylindrical	1. *C. Fistula.*
A shrub, leaves with interpetiolar glands; pods flat . .	2. *C. auriculata.*
Shrubby or herbaceous; leaves without glands; pods flat, broad, oblong, obtuse.	
Leaflets obovate, obtuse; valves of pod crested . .	3. *C. obovata.*
Leaflets lanceolate, acute; valves of pod without appendages .	4. *C. angustifolia.*
Leaflets oblong, obtuse; valves of pod without appendages .	5. *C. holosericea.*

1. **C. Fistula,** Linn.; Roxb. Fl. Ind. ii. 333; W. & A. Prodr. 285.—Syn. *Cathartocarpus Fistula,* Pers. *The Indian Laburnum.* Sans. *Suvarna.* Vern. *Amaltās* (fruit and tree), North India. Local names: *Karangal, kiār, kaniār, ali,* Pb., Himal.; *Chimkani* (rattler), Sindh; *Girmala, gurmala, garmalu,* Dekkan, Guzerat; *Kitwāli, kitola, itola, shimarra, sīm,* N.W.P.; *Warga,* Oudh; *Jaggarwah, raila, hirojah,* C.P.; *Jaggra-marra,* Gonds, C.P.; *Gnūshwoay,* Burm.

A moderate-sized tree, nearly glabrous, extremities pubescent. Leaves 12-18 in. long, leaflets 4-8 pair, ovate or ovate-oblong, 2-5 in. long, on petioles ¼ in. long, lateral nerves numerous, approximate, branching, stipules minute, conical or setaceous. Flowers racemose, large, bright yellow, fragrant, on long slender pedicels in the axils of minute bracts which are caducous long before expansion; racemes lax, pendulous, 1-2 ft. long. Calyx of 5 nearly equal, ovate obtuse lobes; petals oval, narrowed into short claws, nearly equal. Stamens unequal, the 3 lower longest, on incurved filaments, with oblong anthers, dehiscing longitudinally, 4-6 intermediate, with the anther-cells diverging at the base, and opening at that end by pores, the remaining 1-3 very short, with indehiscent anthers. Pod cylindrical, pendulous, 1-2 ft. long, 1 in. diam., dark brown, smooth, hard, indehiscent, divided into numerous flat 1-seeded cells by thin transverse partitions, filled with a soft black sweetish pulp. Seeds flat, smooth, shining, the flat cotyledons with curved edges, so as to be S-shaped in the transverse section.

Common throughout the forest-tracts of India. Trans-Indus on the hills near Peshawar; ascends to 4000 ft. in the outer Himalaya. Leafless for a short time in the dry season; the fresh leaves of a lively green colour, appear April-May. Fl. in spring, and occasionally a second time in autumn. Pods ripen in the cold season.

In Northern and Central India a small tree, rarely exceeding 30 ft., with a short trunk 3-5 ft. girth. Bark thick (¾ in.), yellowish or greenish grey, darker in old stems, with cross-wrinkles and shallow longitudinal cracks, and brown, irregularly shaped, exfoliating scales. Sapwood large, heartwood brick-red when fresh-cut, red or reddish brown when seasoned, often beautifully mottled and streaked, hard, tough, works easily, takes a fine polish, but is somewhat brittle, and apt to crack. The cub. ft. of green wood weighs 72-78 lb.; for seasoned wood, Skinner gives the average at 61, the extremes of the experiments available are 52 and 66. The coefficient of transverse strength (P.) is 846 (Skinner). The annual rings are fairly distinct, the pores large, uniformly distributed, save occasionally in a narrow line of autumn wood without pores. Each pore in a patch of white tissue, and these patches joined by wavy lines of similar tissue. Very durable, but large pieces are rare. Used for posts, ploughs, bows, and spars of native boats. Axles of carts are made of it in Burma.

The bark is used for tanning and dyeing; red juice exudes from wounds in the bark, which hardens into a gum, called *Kamarkas*, used like the gum of *Butea frondosa*. The pulp which fills the pod is a strong purgative, used largely in native medicine, as well as in Europe (Pharm. Ind. 65). Twigs and leaves are lopped for cattle-fodder in Oudh and Kamaon.

2. **C. auriculata**, Linn.; W. & A. Prodr. 290.—Syn. *Senna auriculata*, Roxb. Fl. Ind. ii. 349. Vern. *Tarwar*, *Awal*.

Pubescent. Leaves 3-5 in. long; leaflets 8-12 pair, oval, obtuse, mucronate, with short filiform glands at the base of each pair. Stipules large, foliaceous, semicordate. Flowers yellow, in terminal, corymbose, leaf-bearing panicles. Calyx-lobes unequal, petals equal, ovate, unguiculate, twice the length of calyx. Perfect stamens 6 or 7, with long cylindrical anthers; antherless staminodes 3 or 4. Pod flat, 3-4 in. long, ½ in. broad, with 4-6 seeds.

A shrub, common in South and Central India, also in Rajputana. The bark is used for tanning and dyeing leather, and the root in the manufacture of steel. Fl. Oct.-March.

To this genus belong the plants which yield the Senna leaves (Pharm. Ind. 65). They are shrubs, undershrubs, or herbs, leaves without glands, flowers in axillary racemes; pods flat, broad, arcuate, dehiscent; natives of tropical Africa; the following 3 species extending to North-West India, and 2 of them to the dry belt of South India.

3. **C. obovata**, Colladon; Boiss. Fl. Orient. ii. 631.—Syn. *Senna obtusa*, Roxb. Fl. Ind. ii. 344. *Cassia obtusa*, W. & A. Prodr. 288; Wight Ic. t. 757.

A diffuse procumbent perennial herb, with glabrous, obovate, obtuse leaflets in 3-7 pairs; stipules obliquely lanceolate, acuminate, spreading or decurved. Racemes erect, at length exceeding the subtending leaf. Pod oblong-reniform, broadly rounded at the extremity, the valves thinly coriaceous, and marked longitudinally over the seeds with a single series of rounded crest-like plaits.

Salt range to 2500 ft. (*sanna*), and Trans-Indus (*jījan*), Sindh, Guzerat, South India, tropical Africa.

4. **C. angustifolia,** Vahl.—Syn. *C. lanceolata,* Forsk.; Royle Ill. t. 37. *Senna officinalis,* Gærtn.; Roxb. Fl. Ind. ii. 346. Vern. *Sanna makki,* Pb.

A bushy herbaceous plant. Leaflets 5-8 pair, narrow ovate-lanceolate, stipules subulate, spreading or reflexed. Racemes exceeding the subtending leaf. Pod broadly oblong, slightly curved, rounded at the extremity, the valves chartaceous, glabrous, smooth, without appendages.

Sindh, Guzerat, South India, cultivated in the N.W. Provinces.

5. **C. holosericea,** Fresenius; Oliver Fl. Trop. Afr. ii. 278.

A small shrub. Leaflets oblong, 5-8 pair, closely velvety pubescent above and beneath; stipules subulate, spreading, somewhat rigid. Racemes erect, shorter than leaves. Pod flat, broadly falcate-oblong, rounded at the extremity; valves thinly chartaceous, pubescent, without appendages.

Abyssinia, Nubia, Arabia, Aden, Sindh.

Ceratonia Siliqua, Linn., the *Carob tree* (*Algaroba*), is indigenous in Spain and Algeria, the eastern part of the Mediterranean region, and in Syria; its flat pods, full of sweet, nutritious pulp, are a common article of food in the Mediterranean for man, horses, pigs, and cattle, and are imported into the Panjab under the name of *Kharnūb nūbti.* A slow-growing evergreen tree, with heavy wood, excellent as fuel, and valued for cabinet-work, has great powers of reproduction, and is satisfied with a scanty supply of moisture. It has been grown in the Panjab, and may prove a valuable introduction. Its characters are somewhat anomalous. Abruptly pinnate leaves, small polygamous or diœcious flowers, without petals, with 5 stamens, versatile anthers, and a broad disc surrounding the ovary. The structure of the seed, with thick, flat cotyledons, enclosed in a fleshy albumen, brings it near the genus *Cassia.*

8. SARACA, Linn.

Unarmed trees, with abruptly pinnate leaves, and small, caducous stipules. Flowers yellow or red, in short panicles. Calyx-tube long, funnel-shaped, lined with the disc, limb cleft into 4 petaloid, ovate, nearly equal segments, imbricate in bud. Petals wanting. Stamens 3-9, free; anthers oblong, dehiscing longitudinally, on long filaments. Ovary stipitate, the stalk adnate to the calyx-tube; style filiform; stigma terminal, obtuse. Pod oblong, coriaceous or woody, 2-valved. Seeds without albumen.

1. **S. indica,** Linn.; Bedd. Fl. Sylv. t. 57.—Syn. *Jonesia Asoca,* Roxb. Fl. Ind. ii. 218; W. & A. Prodr. 284; Wight Ic. t. 206. Sans. *Asoka, vanjula.* Vern. *Asok, Asoka* (*Jasundi,* Bombay).

Glabrous, leaves 12 in. long, drooping and coloured when young. Leaflets opposite, 4-6 pair, lanceolate, coriaceous, smooth, shining, 3-9 in. long. Stipules intrapetiolar, oblong, striate. Flowers in corymbose panicles, terminal, or at the end of short lateral branches, with numerous ovate, ciliate, coloured bracts, 2 at the base of the calyx persistent, the others at the ramifications of the panicle deciduous. Peduncles and pedicels coloured, flowers orange on expanding, gradually changing to red. Edge of the disc a crenulated ring at the mouth of the calyx-tube. Pod 6-10 in. long, 2 in. broad, valves hard, woody, reticulate outside. Seeds 4-8, smooth.

Indigenous in the forests of South India and Eastern Bengal, cultivated near Hindu temples and in gardens in most parts of India. Fl. March, April; fr. ripens Aug., Sept. Heartwood hard, dark-coloured.

THIRD SUB-ORDER, **MIMOSEÆ**.

Trees, shrubs, rarely herbs, with abruptly bipinnate, rarely pinnate leaves, and small flowers in heads or spikes. Flowers regular, occasionally polygamous. Sepals generally connate into a 5-lobed calyx, rarely free, valvate. Petals hypogynous, as many as sepals, usually connate, valvate. Stamens hypogynous, as many as sepals, double their number, or numerous, free or monadelphous, with small, 2-celled anthers, the cells dehiscing longitudinally. Pollen (in species of *Acacia*, *Albizzia*, and *Pithecolobium*) cohering in 3-4 masses in each cell. Seeds without albumen, the embryo with a straight radicle.

- Stamens 10; anthers with deciduous apical glands.
  - Flowers in spikes or racemes (Indian species).
    - Unarmed climbers; pods 2-3 ft. long, flat, constricted between seeds . . . . 1. ENTADA.
    - Shrubs or trees, often spinescent.
      - All flowers bisexual, or sterile flowers mixed with the fertile.
        - Flowers pedicelled, in long slender racemes; pods 2-valved . . . . 2. ADENANTHERA.
        - Flowers sessile, in slender cylindrical spikes; pods 2-valved . . . . 3. PIPTADENIA.
        - Flowers sessile, in cylindrical spikes; pods indehiscent 4. PROSOPIS.
      - Upper flowers of the dense cylindrical spikes bisexual, the lower neuter . . . . 5. DICHROSTACHYS.
  - Flowers in globose heads; pod thick, woody, falcate . . 6. XYLIA.
- Stamens 8-10 or more, but definite, anthers without glands.
  - Pods flat, linear, 2-valved . . . . 7. LEUCÆNA.
  - Pods 2-valved, the valves separating in joints or entire from the persistent frame . . . . 8. MIMOSA.
- Stamens indefinite, more or less connate.
  - Armed or unarmed trees; pinnæ 1-2 pair; pods coriaceous, twisted . . . . 9. PITHECOLOBIUM.
  - Unarmed trees; pinnæ generally numerous; pods thin, flat, straight, 2-valved . . . . 10. ALBIZZIA.
- Stamens indefinite, free; armed trees, shrubs or climbers; pods dehiscent or indehiscent, flat or turgid . . . . . 11. ACACIA.

1. **ENTADA**, Linn.

1. **E. scandens**, Benth. in Hook. Journ. of Botany, iv. (1842) 332.—Syn. *E. Pursætha*, DC.; W. & A. Prodr. 267. *Mimosa scandens*, Roxb. Fl. Ind. ii. 554. Vern. *Gilla*, Beng.; *Gardal*, Bombay.

A large climber, stems angled, often curiously twisted and curled. Glabrous, but inflorescence pubescent. Common petiole ending in a long, woody, bifid tendril. Pinnæ 2 pair; leaflets 3-4 pair, 1-3 in. long, shining. Flowers pale yellow, sessile, in long slender spikes, generally 4-8 on a common peduncle, from the axils of the former leaves, on 2-3 year-old branchlets. Pods ligneous, of an immense size, 2-4 ft. long, 3-4 in. broad, constricted between the seeds, consisting of 10-30 1-seeded, flat, rounded joints, the valves separating from the more durable thick rim. Seeds flat, ovate or nearly orbicular, brown, shining, testa very hard.

South India, Eastern Bengal, Nepal, Burma, Ceylon, Indian Archipelago, Fiji Islands, Queensland. West Indies (probably the same species, the seeds carried by the Gulf Stream to the western shores of Europe). Fl. March-May; fr. Dec., Jan. The seeds are eaten, cooked or roasted; children play with them, and they are made into snuff-boxes and other articles.

2. **ADENANTHERA**, Linn.

Flowers bisexual, pentamerous, pedicelled, in slender axillary or paniculate racemes. Calyx campanulate, with short teeth. Petals free or connate at the base. Stamens 10, free; the anther-cells adnate to a broad connective, bearing a deciduous gland at the top. Ovary sessile or short stipitate, with numerous ovules in 2 rows, a filiform style, and a small terminal stigma. Legume linear, 2-valved, the valves often contorted after opening. Seeds thick, with a hard red or bi-coloured testa.

1. **A. pavonina**, Linn.; Roxb. Fl. Ind. ii. 370; W. & A. Prodr. 271; Wight Ill. t. 84; Bedd. Fl. Sylv. t. 46.—Sans. *Kuchandana.* Vern. *Thorlagūnj*, Mar.

A large tree, glabrous or pubescent, unarmed. Leaves 1-3 ft. long, abruptly bipinnate, pinnæ opposite, 4-6 pair; leaflets alternate, elliptic-oblong, obtuse, 4-12 pair. Racemes paniculate, cylindrical, pedunculate, about 4 in. long. Flowers small yellow, fragrant, on slender pedicels. Legumes linear, twisted, about 9 in. long. Seeds shining, hard, bright scarlet, compressed, but convex on both sides, oval or orbicular.

South India, Burma, Bengal. Known to extend as far as Khandeish and Guzerat on the west side of India, and as far as Sikkim on the east side, but will probably be found in the forests of Gorakhpur, Oudh, and Central India south of the Satpuras. Fl. March-May; seeds ripen Aug.-Oct.

Trunk erect, bark rough, dark-coloured. The wood is described by Skinner as follows: "Heartwood hard and durable, when fresh-cut of a beautiful coral-red colour, and sometimes marked with stripes of a darker shade; after exposure it turns purple, resembling Rosewood; weight 56 lb. P. = 863." The seeds are worn as ornaments, and used as weights (about 4 grs.) by goldsmiths and jewellers. Oil is expressed from them.

3. **PIPTADENIA**, Benth.

Characters of Adenanthera, but pods linear, flat, not contorted; seeds flat. Flowers sessile.

1. **P. Oudhensis.**—Syn. *Adenanthera Oudhensis*, J. L. Stewart, MSS. Vern. *Genti, gainti*, Oudh.

A moderate-sized tree, armed with large conical prickles. Glabrous, inflorescence only pubescent. Leaves abruptly bipinnate, pinnæ 2 pair, common petiole about 3 in. long, with a large, flat, circular gland at the base of the lowest pair; secondary petiole 1 in. long, bearing 1 pair of sessile, subcoriaceous, reniform leaflets, 2-3 in. long and 1½-2 in. broad. Flowers greenish yellow, sessile or nearly sessile, in dense cylindrical spikes 1-3 in. long, arranged in short axillary panicles. Calyx cup-shaped, nearly truncate, with 5 short teeth. Petals 5, lanceolate, 3 times longer than calyx. Stamens longer than petals, terminal glands globose. Pod stalked, linear, flat, 9-12 in. long, ½ in. broad. Seeds 15-20, compressed, brown, broad-oval.

Discovered in March 1871, by *Mr Richard Thompson*, in the Oudh forests under the base of the hills in the Gonda division, where it is common, clothing the sides of the hills, and entering into them along the valleys. The leaves are renewed in March, and the tree flowers in April.

Attains 40 ft., with a short trunk, which divides into numerous upright branches, with drooping branchlets, resembling *Hardwickia binata* in general appearance. Bark of younger branches smooth or wrinkled, with large, conical, compressed, sharp-pointed prickles. Bark of stem and older branches ½ in. thick, grey, brown, to dusky red, rough with flattish, exfoliating, woody scales. Inner bark red, fibrous. Wood light red, close-grained, durable, very hard; seasons well without cracking. Heartwood not distinct. The trees are pollarded for cattle-fodder.

4. PROSOPIS, Linn.

Flowers bisexual, pentamerous, generally sessile, in spikes or heads. Calyx campanulate, with 5 short teeth. Petals valvate, free or connate below. Stamens 10, free, exserted; anthers tipped with a sessile or stipitate gland. Ovary sessile, with numerous ovules, a slender style, and a small terminal stigma. Legume coriaceous, indehiscent; the seeds embedded in a spongy, hard, or scanty pulp.

Pod linear, contracted between seeds, pinnæ 2 pair .	1. *P. spicigera.*
Pod short and thick, pinnæ 2-5 pair	2. *P. Stephaniana.*

Several trees of this genus form a marked feature in the vegetation of the dry regions of Chili, Peru, Texas, and Mexico, with sweetish succulent pods called *Algarobo*, eaten by the Indians, and given to horses.

1. **P. spicigera**, Linn.—**Tab. XXV.**—Roxb. Cor. Pl. t. 63; W. & A. Prodr. 271; Bedd. Fl. Sylv. t. 56; Boissier Fl. Orient. ii. 634.—Syn. *Adenanthera aculeata*, Roxb. Fl. Ind. ii. 371. Vern. *Jand, jhand, jānt, khār* (pod *Sangri, Sankar*), Pb.; *Kandi, kundi*, Sindh; *Chaunkra*, Agra, Bhurtpur; *Khejra, khejri*, Rajputana; *Sangri, shangri*, Pertabgarh; *Sĕmru, sĕmri, sŭmri, hamra*, Panch Mehals, Guzerat; *Shemi, shema, saunder*, Dekkan.

A moderate-sized thorny tree. Glabrous, branches and branchlets armed with scattered, broad-conical, somewhat compressed prickles. Leaves bipinnate, pinnæ opposite, usually 2 pair, leaflets 7-10 pair, obliquely oblong, cuspidate, more or less distinctly 3-nerved. Spikes slender, in short axillary panicles. Flowers small, yellow, in the axils of ovate, obtuse, membranous bracts. Calyx cup-shaped, membranous. Pod pendulous, linear, contracted between seeds, 5-10 in. long, filled with a brown mealy substance.

Common and gregarious in the Panjab, Rajputana, north and middle Sindh, where the tree forms extensive forests, pure, or mixed with *Capparis aphylla*, *Salvadora*, and a few species of *Acacia*. In the Panjab, these forests are on the high land (Bār) between the main rivers. In Rajputana, they are likewise on high ground, (Bhartpur, Kishengurh, Meywar). But in Sindh, with less moisture, and a normal annual rainfall of less than 10 inches, they generally are found at no great distance from the river. *Prosopis*, however, in Sindh, thrives on ground more dry than the *Tamarisk*, the *Poplar*, and *Acacia arabica*, the pure *Prosopis* forests being generally beyond the range of actual inundation. Ascends to 1500 ft. on the hills Trans-Indus, and in the Salt range. Also in Guzerat, Bandelkhand, the Dekkan, and in the dry region of the Peninsula as far south as Tuticorin. Outside India in Beluchistan, Persia, Mascat. I have never found it where the annual rainfall exceeds 40 inches, and it seems to thrive best where the rainfall is less than 30 inches. In Meywar, *Prosopis* is common north of the Bunass river, and is there universally called *Khejri*. It is often associated with *Acacia leucophlœa* (*Arinj*). South of the Bunass, *Prosopis* is scarce, but retains its name as far as Pertabgarh, where it is called *Sangri*. *A. leucophlœa* continues to be common south of the Bunass, and is there called *Khejra*.

The tree is leafless for a short time; the young foliage comes out early in March; fl. in Feb. (Guzerat), in March, April (Sindh), in April, May (Panjab). The fruit ripens from May-Aug. Easily raised from seed; young trees do not suffer from frost; throws out vigorous coppice-shoots. Growth probably slow, 3 ft. girth in 30 years (Saharanpur gardens), 4-5 indistinct annual rings per in.

Attains 30-40 ft., with a short erect trunk, generally under 6 ft. girth, attaining 10-12 ft. girth and 60 ft. height in Sindh. For dimensions of exceptionally large trees, see Panjab Plants, p. 74. Branchlets drooping, foliage light. The base of the stem is often surrounded by a mass of stiff, thorny, entangled branches and suckers. There is a cupressiform variety, with ascending branches and a narrow crown. Bark ¾ in. thick, dark grey, or light brownish grey, rough, with deep longitudinal furrows and horizontal cracks. Adult foliage grey, round galls common on leaflets, and woody excrescences on branches and branchlets.

Wood light, yellowish brown, with irregular masses of dark-brown or black heartwood in the centre of old trees. Marked wavy concentric lines. Coarse-but even-grained. Weight in the Panjab and Sindh between 49 and 58.5 lb. per cub. ft. when seasoned, 82 when green (Dalzell, Fenner, and Stewart). Skinner gives 72 lb. for seasoned and 95-100 lb. for green wood, with 981 for the value of P.; but the identification of the wood experimented upon seems open to doubt. Easy to work, tough, but not durable, liable to dry-rot, and readily eaten by insects. Used for building, for carts, and agricultural implements; is a favourite wood for well-curbs in parts of the Panjab; ordinary furniture is made from it in Sindh. A good fuel for steamers and locomotives, its heating power being near that of Babool, and much higher than that of the Tamarisk. Experiments made at Karāchi in May 1869 gave the following results:—

Of the wood of	*Prosopis spicigera*,	1374 lb.	were consumed in evaporating 11.8 cub. ft. of water per hour during 7 hours, the pressure of steam being kept at 27 lb. on the square inch.
	Acacia arabica,	1388 „	
	Tamarix gallica,	1627 „	

Nevertheless, Tamarisk-wood is often preferred in the Indus steamers, probably because the pieces have a more convenient shape, and are easier handled.

A mild gum, not used, exudes from wounds in the bark. The pod (*Sangri*, *sankar*, Pb.), is much used as fodder for camels, cattle, and goats; the mealy, sweetish substance which surrounds the seeds is an article of food in parts of the Panjab, Guzerat, and the Dekkan. The pods are collected before they are quite ripe, and the mealy pulp is eaten raw, or boiled with vegetables, salt, and butter. Is considered indigestible if consumed in large quantities. The tree is worshipped by Hindus at the Dussera festival.

2. **P. Stephaniana**, Kunth; Boissier Fl. Orient. ii. 633.—*Jembūt*, Arab.

A small thorny shrub, 2-2½ ft. high, with smooth white bark, extremities and leaves hairy. Pinnæ 2-5 pair; leaflets 8-12 pair, linear. Pods short, thick, 1-1½ in. long, black, rugose, with 6-7 seeds.

Peshawar valley, and further east, sparingly as far as Amballa. Beluchistan, Afghanistan, Persia, Syria, Asia Minor, Egypt, Turkestan. Never leafless; small roundish excrescences common on branchlets and leaves.

5. DICHROSTACHYS, DC.

Flowers sessile, pentamerous, in dense cylindrical spikes, the upper flowers of each spike bisexual, the lower neuter, with long, much-exserted, filiform staminodes. Teeth of calyx short. Petals valvate, more or less connate. Stamens 10, free, exserted; anthers tipped with a globose, often stipitate gland. Ovary subsessile, multiovulate; style slender, stigma terminal. Legume linear, compressed, coriaceous, twisted, indehiscent, or irregularly opening. Seeds compressed, shining.

1. **D. cinerea**, W. & A. Prodr. 271; Bedd. Fl. Sylv. t. 185.—Syn. *Mimosa cinerea*, Roxb. Cor. Pl. 174; Fl. Ind. ii. 561. Vern. *Vurtuli*, Hind.; *Kunlai*, *kunrat*, Mairwara.

A rigid thorny shrub, or small tree, with white or grey bark. Pubescent, armed with axillary spines, straight, strong, and sharp, often prolonged into leaf-bearing branches. Leaves bipinnate, generally 1-2 in. long; pinnæ 8-10 pair, with stipitate glands at the base of each pair; leaflets small, ciliate, 12-15 pair. Stipules subulate, ¼ in. long. Spikes axillary, pedunculate, solitary, or 2-3 together, as long as, or shorter than leaves; bracts lanceolate, membranous. Upper fertile flowers yellow, the lower sterile flowers white, purple, or rose-coloured. Pods 2-3 in. long, ¼ in. broad, irregularly twisted, generally 3-8 on one peduncle; seeds 10-15.

Common on dry stony hills in South and Central India; has been found as far north as Futtehgarh on the Ganges, near Jeypur, and on the hills of Mairwara, near Todgarh. Fl. hot season. Bark of trunk soft, with deep longitudinal furrows. Heartwood hard, dark reddish brown.

6. XYLIA, Benth.

1. **X. dolabriformis**, Benth. l. c. 417; Bedd. Fl. Sylv. t. 186.—Syn. *Inga xylocarpa*, DC.; W. & A. Prodr. 269. *Mimosa xylocarpa*, Roxb. Cor. Pl. t. 100; Fl. Ind. ii. 543. *The Ironwood of Burma.* Vern. *Jamba*, Konkan; *Boja*, Godavery forests; *Pynkado*, Burm.

A large tree, unarmed. Common petiole short, 1-2 in. long, bearing 1 pair of pinnæ, with 2-6 pairs of oblong or ovate-oblong acuminate leaflets, 3-9 in. long, the terminal leaflets largest. Flowers pale yellow, in globose, tomentose, long-pedunculate flower-heads, 1 in. diam. Petals linear, valvate, slightly cohering at the base. Stamens 10, free; anthers basifixed, with deciduous stipitate glands. Pod thick, woody, flat, falcate, 4-6 in. long, 2-2½ in. broad at the broadest part. Seeds 8-10, oval, compressed, shining, ½ in. long.

Burma, South India, extending to the Godavery forests on the east side, and (as far as known at present) to the Colaba district on the west side. (Included in Forsyth's List of Central Prov. timber-trees.) Leafless during part of the dry season. Fl. March-April; fr. autumn. Bark grey. Trunk tall, of great girth. Heartwood dark red, very hard; weight between 58 and 70 lb. Aver. of P. 800.

7. **LEUCÆNA,** Benth.

1. **L. glauca,** Benth. in Hook. Journ. Bot. iv. (1842) 416.—Syn. *Acacia frondosa,* Willd.; W. & A. Prodr. 275.

A shrub or small tree, unarmed, with large bipinnate leaves, linear leaflets, white flowers in globose, axillary heads, forming short terminal leafy panicles. Petals 5, free, linear, valvate. Stamens 10, anthers versatile, without glands. Pods clustered in umbels of 3-6, linear, stipitate, thin, flat, shining, 4-6 in. long, 2-valved, with numerous prominent seeds.

Indigenous or naturalised in most tropical countries, commonly cultivated in gardens in India; not uncommon in the outer valleys of Garhwal and Kamaon. Fl. June-Aug.; fr. autumn.

8. **MIMOSA,** Linn.

Herbs, shrubs, or trees, with bipinnate, often sensitive leaves, generally without petiolar glands, but with stipels at the base of pinnæ. Flowers in globose heads or cylindrical spikes, tetramerous or pentamerous, rarely tri- or hexamerous. Calyx minute, pappiform, rarely campanulate. Petals more or less connate, valvate. Stamens definite, generally twice the number of petals, and more than twice their length. Anthers small, without glands. Ovary with 2 or many ovules, style filiform, with a small terminal stigma. Pod oblong or linear, the valves membranous or coriaceous, separating entire or in transverse joints from the persistent sutural frame.

1. **M. rubicaulis,** Lam.; Hooker Ic. Plant, ii. t. 156; W. & A. Prodr. 268.—Syn. *M. octandra,* Roxb. Cor. Pl. t. 200; *M. mutabilis,* Roxb. Fl. Ind. ii. 564. Vern. *Rāl, khair, didriār,* Pb.; *Agla,* Kamaon; *Kīngli, kīngrei,* Rohilkhand; *Kacheyta,* Gorakhpur; *Hajeru,* Sindh.

A large, straggling, prickly shrub, 10 ft. high. Pubescent; branches, petioles, and peduncles armed with short, curved, sharp prickles. Pinnæ 3-10 pair; leaflets 6-15 pair, unequal-sided, linear-oblong, obtuse. Flower-heads on peduncles 1-1½ in. long, solitary or fasciculate, forming racemes near the ends of branches. Flowers tetramerous; calyx short-campanulate, 3 or 4 times shorter than the funnel-shaped corolla. Stamens 8. Pods stipitate, glabrous, armed or unarmed, 3-5 in. long, ½ in. broad, curved, separating from the sutural frame in square joints.

Common in open or thin jungles throughout the greater part of India, in the plains extending to the Ganges, and in the hills as far as the Indus (ascending to 4000 ft. in Kamaon); in the Panjab, abundant in the outer hills and the Siwalik tract, and found at times on the banks of rivers or canals, some way into the plains. Fl. Aug.-Sept.; fr. Nov.-Jan. Gunpowder is made of the charcoal.

9. PITHECOLOBIUM, Martius.

Shrubs or trees, with bipinnate leaves, generally with glands at the base of pinnæ and leaflets. Flowers generally white, in globose heads or cylindrical spikes; pentamerous, rarely hexamerous, generally bisexual. Calyx campanulate or tubular, with short teeth. Corolla tubular or funnel-shaped, segments valvate. Stamens indefinite, much longer than corolla, more or less connate; anthers small. Ovary with numerous ovules; style filiform, with a small terminal stigma. Pod compressed or flat, variously contorted, coriaceous, 2-valved. Seeds included in a scanty pulp.

Leaflets 1 pair; pod turgid, twisted	*P. dulce.*
Leaflets 2-4 pair; pod flat, spirally contorted . . .	*P. bigeminum.*

1. **P. dulce**, Benth. in Hooker's Journal of Botany, iii. (1844) 199; Bedd. Fl. Sylv. t. 188.—Syn. *Mimosa dulcis*, Roxb. Fl. Ind. ii. 556; Pl. Cor. t. 99. *Inga dulcis*, Willd.; W. & A. Prodr. 268. *Manilla Tamarind.* Vern. *Vilāyati* (foreign) *imli, dakhani* (southern) *babool.*

A large tree, armed with short, straight, stipulary thorns. Glabrous or lightly pubescent. Pinnæ and leaflets 1 pair each; leaflets unequal-sided, oblong or obovate, obtuse, 1-1½ in. long. Common and partial petioles terminate in short bristles; small cup-shaped glands at the base of pinnæ and leaflets. Flowers white, in small globose, sessile or short-pedunculate, canescent heads, on long racemose panicles. Pod turgid, twisted, linear, ⅓ in. broad. Seeds embedded in a firm sweetish pulp.

Indigenous in the hot regions of Mexico, introduced into the Philippine Islands, and thence into India. Cultivated commonly in South India, and here and there in Central and North-West India.

A large tree, with a straight stem, and drooping branchlets. Bark ⅓-½ in. thick, ash-coloured, smoothish, irregularly rugose. Fl. Jan.-March; fr. ripens April-June. Sapwood small, heartwood reddish brown, not heavy, 40 lb. per cub. ft., smells unpleasantly when fresh-sawn, used for various purposes. A good avenue-tree. Coppices well in South India, grown for fuel. Extensively cultivated as a hedge-plant. In Manilla it is grown on account of the fruit, which is eaten. From the seeds oil is pressed in Madura and Tinnevelly.

2. **P. bigeminum**, Martius; Benth. l. c. 206.—Syn. *Inga bigemina*, Willd.; W. & A. Prodr. 269. Vern. *Kachlora*, Kamaon.

A large, unarmed, glabrous tree, extremities inflorescence, and pods with short, dark, ferruginous pubescence. Common petiole short, 1-3 in. long, with a raised oval gland, bearing 1, rarely 2 pairs of pinnæ, with 2-4 pairs of large, shining, ovate or elliptic-oblong, acuminate leaflets, 3-6 in. long. Heads with 6-12 subsessile flowers, in axillary panicles. Peduncles fasciculate, but generally superposed, in a vertical line, one above the other. Pods flat, linear, ¾ in. broad, curved, generally spirally contorted, dark brown outside, reddish brown inside.

Forests of the western coast, Eastern Bengal, Nepal, and Kamaon, Ceylon. Indian Archipelago. Fl. March-May. Heartwood dark-coloured; it is sometimes called Ironwood.

10. **ALBIZZIA**, Durazzini.

Unarmed trees or shrubs, with bipinnate leaves and large (in the Indian sp.) globose flower-heads. Flowers white, yellow, or rose-coloured, usually pentamerous. Calyx tubular to campanulate, toothed. Petals 4-5, united half their length or more, valvate. Stamens indefinite, exserted, generally exceeding ½ in.; filaments united at the base, or in a long exserted sheath; anthers minute, pollen cohering in 3-4 masses in each cell. Legume straight, flat, oblong or broadly linear, indehiscent or 2-valved, valves usually thin, continuous or sinuous from abortion of seeds. Seeds compressed.

Pinnæ 1-2 pair; leaflets 1-3 pair, penniveined, 3-5 in. long . 1. *A. lucida.*
Pinnæ 2-8 pair; leaflets ½-2 in. long, broad-oblong, main nerves in the middle or nearly so.
  Extremities rusty- or grey-tomentose; pinnæ 3-8 pair; leaflets 10-25 pair . . . . 2. *A. odoratissima.*
  Extremities glabrous or pubescent; pinnæ 2-4 pair; leaflets 3-9 pair.
    Leaflets with 6-10 prominent lateral nerves; flowers ⅓ in. long, sessile, the flower-heads in large terminal panicles; pods brown, 1 in. broad . . . . 3. *A. procera.*
    Leaflets with reticulate veins; flowers 1½ in. long, pedicellate, the flower-heads in short corymbose racemes; pods straw-coloured, 2 in. broad . . . . 4. *A. Lebbek.*
Pinnæ 6-15 pair; leaflets ¼-⅓ in. long, falcate; main nerves lateral.
  Flowers rose-coloured; stipules linear; leaflets 10-30 pair . 5. *A. Julibrissin.*
  Flowers yellow; stipules broad-cordate; leaflets 20-40 pair . 6. *A. stipulata.*
Pinnæ 6-15 pair; leaflets ¼ in. long, linear; midrib in the middle; flowers yellow, fragrant; branchlets with soft yellow down . 7. *A. amara.*

A. lophantha, Benth. Fl. Austral. ii. 421, of Western Australia, introduced on the Nilgiris and now quite naturalised, is a rapidly growing small tree, with 8-10 pairs of pinnæ; leaflets 20-30 pair; flowers in axillary pedunculate spikes.

1. **A. lucida**, Benth.; Lond. Jour. of Bot. iii. (1844) 86.—Syn. *Mimosa lucida*, Roxb. Fl. Ind. ii. 544; *Inga lucida*, Wall.

A large tree; glabrous, peduncles and calyx only slightly pubescent. Common petiole 3-5 in. long, pinnæ 1-2 pair; leaflets 1-3 pair, subcoriaceous, shining, elliptic-oblong, acuminate, penniveined, 3-5 in. long. Peduncles fasciculate, paniculate, bearing heads of 6-10 sessile flowers. Corolla 4 times the length of calyx. Pod linear, straight, 8-10 in. long, 1-1½ in. broad. The foliage somewhat resembles that of *Pithecolobium bigeminum*, but the tree is easily distinguished by the straight pod, and the fasciculate, not superposed, peduncles.

Burma, hills of East Bengal, Nepal, and probably also in the Oudh and Gorakhpur forests, and in Kamaon. Fl. April, May.

2. **A. odoratissima,** Benth. l. c. 88.—Syn. *Acacia odoratissima,* Willd.; W. & A. Prodr. 275; *Mimosa odoratissima,* Roxb. Cor. Pl. t. 120; Fl. Ind. ii. 546; Bedd. Fl. Sylv. t. 54. Vern. *Lasrīn, karāmbru, polach,* Pb.; *Siris, siran, bhandīr,* N.W.P.; *Bersa, bās, bāssein,* C.P.; *Chichwa,* Gonds, Satpura range; *Serissia,* Bassi, Meywar; *Kali Harreri,* Panch Mehals; *Thitmagyi,* Burm.

A large tree, with dark-green foliage. Branchlets, petioles, inflorescence and under side of leaves rusty- or grey-tomentose. Common petiole 6-12 in. long; pinnæ 3-8 pair, 4-6 in. long. Leaflets 10-25 pair, 1 in. long or less, linear-oblong, unequal-sided, pubescent above, pale and tomentose beneath. Flower-heads fasciculate, on peduncles ½-¾ in. long, in compact corymbs, these arranged in lax, terminal panicles. Flowers sessile, pale yellow, fragrant, 1 in. long to extremity of stamens, calyx and corolla hairy. Calyx small, campanulate, 4-5 times shorter than corolla. Legumes broad-linear, 6-8 in. long, 1 in. broad, of a red-brown colour, tomentose when young, glabrous when old, with 10-15 seeds.

South India, Burma, Bengal, Maikal and Satpura range in Central India. Panch Mehals in Guzerat. Bassi forests in Meywar, sub-Himalayan tract west to the Indus, ascending to 3000, and at times to 5000 ft. Fl. April-June; pods ripen Jan., Feb., and remain long on the tree. Never quite leafless, fresh foliage in spring.

Attains a large size in Burma and Western India, in North and Central India 30-45 ft. high, with a tall, nearly straight trunk 5-6 ft. girth. Bark ½ in. thick, light or dark grey, marked with numerous, narrow, horizontal wrinkles, nearly encircling the trunk.

Sapwood less than ¼ of radius, whitish. Heartwood of a rich dark-brown colour, tough and strong. The cub. ft. weighs 38-53 lb. Seasons well, works freely, takes a fine polish, and is fairly durable when kept dry. Used for naves, spokes, fellies, oil-mills, and furniture. A dark-brown gum exudes from wounds in the bark. Leaves and twigs are lopped for cattle-fodder.

3. **A. procera,** Benth.—**Tab. XXVI.**—Lond. Jour. of Bot. iii. 89.—Syn. *Acacia procera,* Willd.; W. & A. Prodr. 275; *Mimosa elata,* Roxb. Cor. Pl. t. 121; Fl. Ind. ii. 548. Vern. *Safed-Siris, Gurār, Karra, karo, ghorar, kharanji, karinji, gurbāri, gurkur, baro,* North and Central India; *Karallu, kinye, kilai, kili, tihiri,* Bombay; *Sītben,* Burm.

A large tree, with yellowish or greenish white bark. Glabrous, young leaves pubescent. Leaves nearly as broad as long; common petiole 6-12 in. long, with a large, brown, oblong gland near its base; pinnæ 3-4 pair, spreading, the upper pinnæ 6-9 in. long. Leaflets 6-8 pair, 1-2 in. long, obliquely-ovate, or oblong-ovate, with 6-10 prominent lateral nerves on either side of midrib. Flower-heads with 15-20 flowers, on peduncles 1 in. long or less, in fascicles of 2-5, forming large, lax, terminal panicles. Flowers yellowish white, sessile, ⅓ in. long to extremities of filaments; calyx tubular, half the length of corolla; segments of corolla oblong, hairy at the end. Legumes linear, 6-9 in. long, ¾-1 in. broad, with 8-12 prominent seeds.

Common near river-banks, on alluvial soil and in moist places, in Burma, Bengal, Gorakhpur, Oudh, South India, and in the sub-Himalayan tract west to the Jumna. Ravines of the Maikal and Satpura range, of the Rewah hills, and of the Barrea hills east of Guzerat. Never quite leafless; the new foliage comes out in April, May. Fl. May, June; fr. Jan., Feb.

Attains 60-80, and at times 100 ft.; trunk large, erect, not regularly shaped, girth 6-9 ft., at times much more. R. Thompson records specimens in the Gonda forests of Oudh 100 ft. high and 19 ft. girth. Bark ½ in. thick or less, yellowish, or greenish white or grey, smooth, with narrow horizontal lines, shallowly and distantly pitted by the falling of thin irregular scales.

Sapwood large, often ⅓ of radius, yellowish white, not durable. Heartwood light or dark brown, with broad wavy belts and patches of a darker colour, annual rings very indistinct. Pores numerous, large, equally distributed. Straight- and even-grained, seasons well, works freely, and is durable. Weight of cub. ft. 40-55 lb. seasoned, 70-80 lb. green, so that it loses nearly half its weight in drying. Largely used for sugar-cane crushers, rice-pounders, wheels, agricultural implements, bridges, and house-posts. It takes a beautiful polish, and, not being heavy, would make a good furniture-wood. In times of scarcity the bark, mixed with flour, has been used as food. The bark is also used for tanning.

Easily raised from seed, and grows readily from cuttings. Growth very rapid, more rapid than of *Siris.* In 12 years attains 3-4, and in 30 years 4-6 ft. (North India).

4. **A. Lebbek,** Benth. l. c. 87; Bedd. Fl. Sylv. t. 53; Boissier Fl. Orient. ii. 639.—Syn. *Acacia Lebbek,* Willd.; *A. speciosa,* Willd.; W. & Prodr. 275; *Mimosa Sirissa,* Roxb. Fl. Ind. ii. 544. *Siris.* Sans. *Sirīsha.* Vern. *Siris, sirisha, shirish, sirīn, sirij, sirāi, kalsis, tantia,* North and Central India; *Serla, sirla,* Banswara; *Harrēri,* Panch Mehals.

A large tree with dark-grey bark. Extremities and leaves glabrous or pubescent. Common petiole 3-12 in., a large gland near the base, and 1 or more interjugal glands; pinnæ 2-4 pair; leaflets 3-9 pair, unequal-sided, oblong, obtuse, subsessile, lateral nerves not prominent, veins reticulate. Peduncles 2-4 in. long, in fascicles of 2-4 from the upper axils, forming a short corymbose raceme. Flowers white, fragrant, glabrous or pubescent, 1½ in. long to the extremities of stamens, on pedicels ⅛ in. long. Calyx campanulate, less than half the length of corolla, with short deltoid teeth. United base of filaments included. Legume 8-12 in. long, linear-oblong, 2 in. at the broadest, of a straw-yellow colour, thin, with 8-12 large, distant, prominent seeds.

Indigenous in the forests of South India, the Satpura range, Bengal, and the sub-Himalayan tract, extending west to the Indus, and ascending to 5000 ft. Cultivated throughout the drier parts of India, in Egypt (avenues of Cairo), Mesopotamia, in Afghanistan near Jellalabad, in tropical Africa, America, and in Australia. Partially leafless for some time in the hot season, the leaves are renewed in March, April, and sometimes there is a second flush in autumn. The flowers chiefly appear in April, May, but often at other times. The pods ripen in Sept., and remain hanging on the tree throughout the cold and hot season.

Attains 40-60 ft., with a girth of 6-8, and at times 10-12 ft. When planted far apart as an avenue-tree, its trunk is short; but, when drawn up by Bamboos and other trees in the forest, it has a long straight stem. Bark ½ in. thick, dark or brownish grey, rough with numerous, short, irregular cracks, and elevated horizontal lines. Sapwood large, often occupying half the radius, whitish. Heartwood dark reddish brown, darker, nearly black bands alternating with bands of lighter colour. Tough, seasons well, works freely, and takes a fine polish; weight of cub. ft. 50-55 lb. Fairly durable. Much valued for sugar-cane crushers, oil-pestles and mortars, furniture, well-curbs, naves, spokes, and other wheel-work. A mild pellucid gum exudes from cracks in the bark. The leaves and twigs are a favourite fodder for camels.

Easily raised from seed; its growth during the first few years is exceedingly rapid. Young plants suffer from frost severely in the Panjab. Trees 12 years old in the Panjab have 2¾ ft. in girth, 30 years 4½ ft., and at Sakkhar in Sindh, on low alluvial soil, trees 17 years old have attained 5-6 ft. in girth. In Sindh and the South Panjab it is often grown from cuttings, which strike root readily, even large sticks and posts put in the ground shooting vigorously. The roots spread widely, but are shallow, and the tree is apt to be blown down. In Central and North-West India it is commonly grown in avenues, but it is an unsightly tree during the hot season with the large, dry, yellow pods hanging on the bare branches. In the Antilles it is called Fry-wood, the sound of the pods in the wind resembling that of frying meat.

The structure of the wood of this and the two preceding species of *Albizzia* is similar; in all three the sap is large; on a longitudinal section the pores are prominently marked, and on a cross-section the heartwood shows darker concentric lines or irregular concentric bands, often interrupted (segments of the circle only). These darker lines or patches probably coincide, in most cases, with the lines separating the wood formed in successive seasons; nevertheless it can by no means be said that these woods have clearly-marked annual rings. The pores are largest in *A. procera;* they are often in groups of 2, and always surrounded by small rounded patches of white tissue; these patches are not generally connected with each other, but, being arranged in more or less concentric lines, they give the appearance of wavy, lighter-coloured bands. *A. Lebbek* has smaller pores, frequently in groups of 2, each pore or group of pores in a patch of lighter tissue, but these patches are always distinct. The medullary rays are somewhat larger in *A. procera* than in *Lebbek.*

5. **A. Julibrissin,** Boivin; Benth. l. c. 91; Boissier Fl. Orient. ii. 639, —Syn. *Acacia Julibrissin,* Willd.; *A. mollis,* Wall. *Pink Siris.* Vern. *Sīrīn, kūrmru, sūrangru, shirsh, būna, tandāi, mathīrshi, brind,* Pb.; *Siris, barau, baraulia, bhokra,* N.W.P. The specific name is a corruption of *Gulāb-resham,* the rose-silk.

A large shrub or moderate-sized tree, extremities and leaves pubescent or tomentose, rarely glabrous. Common petiole 6-12 in. long, a large gland on the naked part, and smaller interjugal glands above. Pinnæ 6-12 pair, leaflets 10-30 pair, unequal-sided, the middle nerve near the upper edge, from a broad and obtuse base oblong-falcate, acute, ½-¾ in. long, ¼ in. broad at base. Flowers light rose-coloured, 1-1½ in. long to the extremity of stamens; peduncles 2-3 in. long, in fascicles of 2-3 from the upper axils, forming short corymbose racemes; pedicels short. Calyx and corolla pubescent, with white silky hairs. Calyx funnel-shaped, half the length of corolla. Filaments irregularly connate at the base, tube included. Legume linear, 4 in. long, ¾ in. broad, pubescent; seeds 4-6.

Outer Himalaya from the Indus to Sikkim, ascending to 5000, and at times to 6000 ft. North Persia, China, Japan. Generally on rocky but moist ground. Fl. April-June; the pods ripen in autumn and remain long on the tree. Cultivated in the Mediterranean region, and in America.

Trunk 5 ft. girth, with a large spreading head, growth rapid. Branchlets dark grey, stiff, flexuose, sulcate. Bark ¼ in. thick, dark grey, with long horizontal wrinkles, and whitish, elevated, oval spots; foliage bright green; growth fairly rapid, 3-4 rings in 1 in. of radius. Sapwood large, yellowish, with numerous white specks; heartwood dark, almost black in old trees, beautifully mottled with lighter and darker shades of colour apparently coinciding with the annual rings. Pores in small detached patches of whitish tissue. Medullary rays conspicuous, shining, very numerous. The wood is hard, strong, moderately heavy, and takes a good polish. Furniture is made of it.

6. **A. stipulata,** Boivin; Benth. l. c. 92; Bedd. Fl. Sylv. t. 55.—Syn. *Acacia stipulata,* DC.; W. & A. Prodr. 274. *A. Smithiana,* Wall.; *A. Kangraensis,* Hort. Sahar.; *Mimosa stipulacea,* Roxb. Fl. Ind. ii. 549. Vern. *Oï, Oë, Sirin, shirsha, kasīr,* Pb.; *Siran, kaunjeria,* N.W.P.; *Pattia, samsundra,* Oudh; *Bummaizah,* Burm.

A large tree, branchlets, petioles, and inflorescence tomentose or pubescent. Stipules large, semi-cordate, membranous, deciduous. Common petiole 6-12 in. long, with a large gland near the base; pinnæ 6-15 pair, 4-5 in. long; leaflets 20-40 pair, ⅓-½ in. long, from a broad base oblong-linear, the middle nerve near the upper edge, acute, pubescent. Flowers yellowish, inodorous, ½ in. to 1 in. long to extremity of filaments; stamens slightly tinged with red. Calyx and corolla pubescent; calyx tubular, half the length of corolla, or somewhat less. Segments of corolla ovate. Flower-heads fasciculate in racemes, on peduncles 1 in. long, supported by broad bract-like ovate stipules, deciduous, and covered with ferruginous tomentum. Legumes 6 in. long, ¾ in. broad, with 8-12 seeds.

South India, Ceylon, Burma, Bengal. Oudh, sub-Himalayan tract west to the Indus, ascending to 4000 ft. Abundant in the Kangra valley, overtopping the coppice-wood of *Quercus annulata.* Young leaves Feb.-March; fl. April-June; pods ripen in autumn.

Attains 50 ft. in North India, trunk not very straight, dividing into large spreading limbs, which support a broad depressed crown, somewhat resembling that of *Poinciana regia.* Extremities of branchlets velvety, branches furrowed. Bark ¼ in. thick, dark grey, with numerous small vertical wrinkles, and a few larger horizontal furrows with prominent edges extending half-way round the trunk, which has the appearance as if it were constricted with cords, smooth pieces flaking off between the furrows. Sapwood large, white, readily attacked by insects; heartwood reddish brown. Pores large, prominently marked on a longitudinal section; weight of cub. ft. 48-56 lb. Not much valued in the Panjab Himalaya. (The wood of Bummaizah from Burma is beautifully mottled.) The branches are lopped for cattle-fodder.

7. **A. amara,** Boivin; Benth. l. c. iii. 90.—Syn. *Acacia amara,* Willd. *A. Wightii,* Grah.; W. & A. Prodr. 274. *Mimosa amara,* Roxb. Cor. Pl. t. 122; Fl. Ind. ii. 548. *M. pulchella,* Roxb. ib. Vern. *Lullei, lallye,* Dekkan.

An unarmed tree; branchlets, petioles, and inflorescence downy, with soft yellowish tomentum. Common petiole 2-4 in. long, pinnæ 6-15 pair. A circular gland on the petiole, and at the insertion of the uppermost pair. Leaflets small, numerous, linear, ¼ in. long, the midrib nearly in the middle of the leaflet. Peduncles fasciculate in the axils of the uppermost leaves bearing yellow fragrant flower-heads of 12-20 sessile pubescent flowers. Corolla three times the length of calyx. Pod linear-oblong, with waved edges, 4-6 in. long and 1 in. broad.

South India, the Dekkan, and near Mundlaysir (Mandleswar), north of the Nerbudda river (Jacquemont). Fl. April-June. Bark smooth, greenish. Skinner describes it as follows: "The wood is strong, fibrous, and stiff, close-grained, hard and durable, of a dark-brown colour, superior to Sāl and Teak in transverse strength and direct cohesive power. Weight 70 lb. per cub. ft. seasoned, P.=1284. Used for beams of native houses, and in the construction of carts; the wood of the crooked branches is used for ploughs."

11. ACACIA, Willd.

Trees or shrubs (the Indian species) armed with prickles or stipular spines. Flowers small, yellow or white, in globose heads or cylindrical spikes, with numerous scaly paleæ between the flowers. Leaves bipinnate (the Indian species). Calyx and corolla usually 4-5-merous; calyx campanulate or cup-shaped, toothed or lobed. Petals valvate in bud, more or less connate or cohering. Stamens indefinite, free, generally very numerous, not exceeding ½ inch in length; anthers minute. Pod dehiscent or indehiscent, seeds compressed.

- Stipules spinescent, generally straight, more or less connate at base; trees or shrubs, not climbing.
  - Flowers in lax spikes; pods thin, broadly falcate . . . 1. *A. Latronum.*
  - Flowers in globose heads; peduncles axillary, fasciculate.
    - Bracts at the base of flower-head . . . . . . 2. *A. Farnesiana.*
    - Bracts in the middle of peduncle.
      - A tree; pods convex, moniliform, contracted between seeds . . . . 3. *A. arabica.*
      - A shrub; pods flat, linear-oblong, ½ in. broad; flowers sweet-scented . . . . 4. *A. Jacquemonti.*
      - A shrub or small tree; pods flat, linear, ¼ in. broad; smell of flowers unpleasant . . . . . . 5. *A. eburnea.*
  - Flowers in globose heads; peduncles paniculate . . . 6. *A. leucophlœa.*
- Stipules not spinescent; two or three infra-stipular, generally recurved, prickles below the insertion of each leaf; flowers in cylindrical spikes; trees or shrubs, not climbing.
  - Pods indehiscent or imperfectly dehiscent.
    - Three infra-stipular prickles; common petiole 1-2 in. long . . . . 7. *A. rupestris.*
    - Two infra-stipular prickles; common petiole 1-2 in. long 8. *A. modesta.*
    - Two infra-stipular prickles; common petiole 3-6 in. long.
      - Leaflets 15-30 pair, oblong-linear, ¼ in. long . . . 9. *A. ferruginea.*
      - Leaflets 6-8 pair, obovate or oblong, 1 in. long . . . 10. *A. lenticularis.*
  - Pods two-valved, dehiscent.
    - Bark dark-coloured; petals 2-3 times longer than calyx . 11. *A. Catechu.*
    - Bark white; petals less than twice the length of calyx . 12. *A. Suma.*
- Stipules not spinescent, prickles not infra-stipular, but scattered; flowers in globose heads; climbing shrubs.
  - Pods thick, fleshy, imperfectly dehiscent . . . . . 13. *A. concinna.*
  - Pods thin, flat, dehiscent.
    - Leaflets subfalcate, subcoriaceous, pale or rust-coloured beneath . . . . 14. *A. cæsia.*
    - Leaflets narrow-linear, membranous, not pale beneath . 15. *A. pennata.*

Several Australian species of this genus have been naturalised on the Nilgiris, and elsewhere in India, the most important of which are: *A. dealbata,* Link.; Benth. Fl. Austr. ii. 415. *The Silver Wattle;* N.S. Wales, Victoria, and Tasmania; a tree spreading rapidly by numberless root-suckers, with grey bipinnate hoary leaves, linear leaflets, and small yellow flower-heads in axillary and terminal panicles. *A. melanoxylon,* Australian Blackwood, R. Brown; Benth. l. c. 388; N.S. Wales, Victoria, Tasmania, and South Australia; a large tree with hard and durable wood, coriaceous phyllodia (vertically dilated leaf-stalks) instead of leaves, except on young trees which have partially bipinnate leaves. Flowers in globose compact heads on short axillary racemes. Sapwood small, heartwood dark brown, often beautifully feathered and mottled, strong and tough, used for axe-handles, other implements, and cabinet-work.

1. **A. Latronum,** Willd.; Benth. in Lond. Jour. of Bot. i. (1842) 506; W. & A. Prodr. 273.—Syn. *Mimosa Latronum,* Roxb. Fl. Ind. ii. 559.

A shrub or small tree, armed with numerous stout stipular spines, connate at the base, generally of two kinds, the smaller ½-1 in. long, the larger 2 in. long, conical, ivory-white and hollow inside. Leaves often fasciculate, common petiole 1-1½ in. long, a gland on the naked part; pinnæ 3-5 pair, 1 in. long or less; leaflets 10-12 pair, small, linear, glabrous or pubescent. Spikes lax, subsessile, often fasciculate, 1-1½ in. long, flowers white at first, turning yellow afterwards, fragrant. Pods thin, subcoriaceous, dehiscent, broadly falcate, 1-1½ in. long, ½-¾ in. broad, 3-4-seeded.

South India, Dekkan. Fl. Jan.-March. Often gregarious, forms formidable thorny thickets. Bark dark brown, dotted with white.

Madden, l. c. 448, speaks of a "very beautiful and exceedingly bushy Acacia" in hot valleys of East Kamaon (vern. *Bhes*), "either *A. dumosa* or *Latronum.*"

2. **A. Farnesiana,** Willd.; Bedd. Fl. Sylv. t. 52.—Syn. *Mimosa Farnesiana,* Linn.; Roxb. Fl. Ind. ii. 557. *Vachellia Farnesiana,* W. & A. Prodr. 272. Vern. *Vilāyati kikar, vilāyati babul, Gū-kikar.*

A thorny shrub, glabrous or pubescent, armed with straight stipular spines. Common petiole 1½-2 in. long, pinnæ 4-8 pair, cup-shaped glands below the lowest, and often at the base of the uppermost pair; leaflets linear, ciliate or nearly glabrous, 10-20 pair. Flowers in globose heads, deep yellow, sweet-scented, supported by broad membranous bracts at the base of the head. Peduncles slender, 3-5, fasciculate. Calyx 5-toothed; corolla tubular, 5-toothed. Pod 2-3 in. long, glabrous, with elevated, nearly parallel, reticulate lines, turgid, nearly cylindrical, scarcely dehiscent, filled with dry spongy tissue and a double row of seeds.

Cultivated all over India, indigenous in America, from New Orleans, Texas, Mexico, to Buenos Ayres and Chili. Fl. Feb., March. Exudes gum, which is collected in Sindh.

3. **A. arabica,** Willd.; W. & A. Prodr. 277; Bedd. Fl. Sylv. t. 47.—Syn. *Mimosa arabica,* Lam.; Roxb. Cor. Pl. t. 149; Fl. Ind. ii. 557. Vern. *Kikar,* Pb.; *Babbar,* Sindh; *Babul, babūr,* N.W.P., Central India.

A tree, with thorny branches. Petioles, peduncles, and branchlets pubescent, leaves glabrous. Stipular spines spreading, generally straight, varying in length ½-2 in. long, smooth, generally whitish, with sharp, often shining brown points. Pinnæ generally 3-6 pair; common petiole 1-2 in. long, cup-shaped glands at the base of the lowest, and generally also of the uppermost pair; leaflets linear, 10-20 pair. Peduncles slender, 3-5, fasciculate, with 2 opposite scaly bracts in the middle of the peduncle. Flowers golden yellow, in globose heads. Corolla campanulate. Pod stalked, compressed, 6 in. long, moniliform, much contracted at both sutures between the seeds, whitish-tomentose, rarely glabrous.

Cultivated or self-sown throughout the greater part of India, save in the most humid regions on the coast, and in the extreme North-West, beyond the Jhelam, where the winter-frost is too severe. Stunted trees are occasionally found as high as 3000-4000 ft. in the North-West Himalaya. In Sindh, near Delhi, in the Ghunna forest near Bhartpur, in Guzerat, and the Koruns of the Northern Dekkan, the tree forms extensive and generally pure forests; the pure Babul forests of Lower and Middle Sindh cover upwards of 27,000 acres. In North Sindh, Babul trees are found in small numbers as standards over underwood of Tamarisk. The tree is probably indigenous in Sindh, and perhaps also in the Northern Dekkan. In the Panjab it is not indigenous. Outside India it is found in Africa, Arabia (*A. nilotica*, Del. Boiss. Fl. Or. ii. 635), with glabrous pods, and (cultivated) in Persia and Afghanistan. The tree is never leafless; the young foliage comes out in Feb. and April. Fl. July-Sept. (Panjab).

Attains 50-60 ft., with a short, not very straight or regularly shaped trunk 10-15 ft. long, and 5-6 ft. girth, attaining 10-12 ft. under favourable conditions, the largest girth recorded being 16½ ft. near Multan (Edgeworth). Branches spreading, forming a fine broad shady crown. Bark thick, dark brown, nearly black, with deep narrow, regular longitudinal fissures, joined by short cross-cracks. Inner bark reddish brown, very fibrous. The sapwood is large, and generally occupies the fifth or sixth part of the radius; it is whitish, coarse-grained, and soft. The heartwood is pale red, nearly colourless when fresh-cut, but on exposure to the air turns red or dark reddish brown, often with blackish streaks. Pores numerous, uniformly distributed, generally surrounded by a small rounded patch of lighter-coloured tissue, often close together in the inner belt of each annual ring, the outer belt having fewer pores, and appearing on that account of a darker colour. Medullary rays numerous; on a longitudinal section the pores and the shining plates or bands of the medullary rays are very prominent. The green wood weighs between 69 and 72 lb. (Stewart), the weight of seasoned wood in the Panjab is 48 (Stewart), in Gwalior 53.7 (Cunningham), and Skinner gives the average (for wood from South India) at 54 lb. The value of P. is 884 (Skinner) and 875, extremes 743 and 1201 (Cunningham). The wood is tough and close-grained, very durable if water-seasoned. It is used extensively for naves, spokes, and fellies of wheels, for well-curbs, sugar-rollers, oil-presses, and rice-pounders, agricultural implements, mallets, axe-handles, and tent-pegs. In Sindh it is much employed in boat-building, particularly for knees and crooked timbers. For construction it is rarely possible to get pieces sufficiently long, but in Sindh it is often used for rafters. It is also used for railway-sleepers. It is an excellent fuel, and has greater heating powers than either *Prosopis spicigera* or the *Tamarisk.*

A gum, similar to gum-arabic, exudes in large quantities from wounds in the bark; it is collected and used in native medicine, by dyers and cloth-printers, and with the gum of other trees it forms part of the East Indian gum-arabic. In Sindh and Guzerat much Lakh is produced on the tree, particularly on the small half-dry branches. When once the insect attacks a tree, it spreads rapidly, killing the small branches as it proceeds, and it is said that it would kill the tree were not the twigs cut off with the Lakh. Good crops of Lakh, however, occur only after one or two dry years, and are said to foretell an unhealthy season. The bark is used for tanning and dyeing, and a decoction of it is used to wash the hair. It is a powerful astringent (Pharm. Ind. 77). In times of scarcity it is ground and mixed with flour. The bark of the root is much used in the preparation of native spirits. The unripe pod, which is very astringent, makes (with an iron-salt) excellent ink; in Africa the pods are used for tanning. Camels, cattle, goats, and sheep delight in the green pods with the tender shoots and leaves; and to obtain the pods and leaves, the trees are often extensively lopped and mutilated.

The Kikar has been cultivated on a large scale in the plantations of the Panjab plains. North-west of the Sutlej river, however, the result has hitherto been unsatisfactory. With sufficient moisture the seed springs up readily, and at first the growth is most rapid and luxuriant. But the plants are mostly cut down by the frosts of December and January; and though they generally shoot up again, the fresh shoots are cut back by the cold of successive seasons, and young trees 10-15 ft. high may often be seen killed by frost to the root. The end is, that a large proportion of trees perish; and thus it has come to pass, that in many places where Sissoo and Kikar had been sown in equal proportions, or where even a larger proportion of the Acacia had been sown, the result has been a forest almost exclusively composed of Sissoo. There are, however, numerous exceptions; successful and thriving Kikar plantations are in existence in the Northern Panjab, between the Chenab and Jhelam rivers, and self-sown Kikar springs up abundantly in fields. Young Beech and silver Fir frequently suffer from frost in their native home in the midst of self-sown forests of their own kind. The latest experience in the Panjab seems to show that Kikar interspersed among other trees escaped the frost, but died when sown by itself in lines. South-east of the Sutlej river, the tree suffers less. Besides frost, the Kikar in its young state has many enemies. The roots are sweetish, and are eaten greedily by rats; pigs also are fond of them, and often dig up young plants; in Sindh the porcupine gnaws the bark round the base of the trunk, and the leaves are often eaten by insects. Young Kikar sends down its tap-root much deeper than Sissoo; in older trees, however, the side-roots develop more than the tap-root, and old Kikar is shallow-rooted and easily blown over. The rate of growth is less rapid than of *Sissoo*, but more rapid than of *Zizyphus Jujuba*. In the Panjab it attains a girth of 2½ ft. in about twelve, and of 5 ft. in about thirty years. In the forests of Lower and Middle Sindh the average growth has been ascertained to be—

At 35 years 4 ft. girth, measured 4 ft. from the ground.
„ 55 „ 6 „ „ „ „

These are averages; under favourable circumstances a much more rapid growth has been noticed. Thus at Jacobabad in Sindh, the Kikar, planted when the station was established in 1844, has attained, in common with the Sissoo and other trees, in less than thirty years 50-60 ft., with girths of 6-8 ft.

The Kikar is not very long-lived, and old trees are generally hollow. It thrives on light and heavy soils, and will even live on Kankar, if the bed is not too thick. It demands a great amount of light, and while young thrives best on a loose soil, ploughed or otherwise, where the air has free access to the roots. The tree coppices fairly well, and may be grown from cuttings. It forms a good hedge when trimmed. Several varieties of this important tree have been described, the most important is var. *cupressiformis*—vern. *Kabuli-kikar*, *kabuli-babbar*, *kikari*. A tall broom-like tree, with close ascending branches, somewhat like a Cypress, common in parts of the Panjab, particularly in the Jech Doab between Jhelam and Chenab, near the station of Jhelam, and about Jhang; also found in Sindh, Rajputana (*Bauli*, at Nibahēra), near Delhi, and in the

Dekkan. (*Rām kanta, rām babūl.*) This variety is easily raised from seed, the seedlings showing at once their peculiar character; in poor soil and with little moisture it is as hardy as the ordinary kind, but its growth appears to be slower. Trees are occasionally found with the branches on one side bent over, while those on the other are erect and ascending. Edgeworth states that near Multan the cupressiform variety and the ordinary form may at times be seen on the same tree.

The variety called *spina albida* is probably no variety at all. All strong young shoots from stumps of felled trees, or from a browsed or mutilated young tree, or luxuriantly growing young plants, have generally very long, strong, white spines, and this has probably given rise to the idea of a variety with white spines.

4. **A. Jacquemonti**, Benth. in London Journ. of Botany, i. (1842) 499. —Vern. *Hanza*, Afg.; *Kikar, babūl, bamūl, babbil*, Pb.; *Ratabauli*, Guzerat.

A small bushy shrub, with stiff flexuose smooth brown branches. Glabrous, stipular spines straight, 1-1½ in. long, ivory-white, connate at base. Pinnæ generally 2-4 pair; common petiole 1-2 in. long; glands small and indistinct; leaflets 5-10 pair, oblong-linear, somewhat fleshy. Peduncles fascicled, 5-10 from each axil, with 2 opposite scaly bracts about the middle of the peduncle. Flowers capitate, yellow, sweet-scented. Legume stipitate, 2-3 in. long, flat, glabrous, broad-linear, ½ in. broad.

East flank of Suliman range, ascending to 2500, and at times to 3200 ft. Outer Himalaya near the Jhelam, to about the same elevation. Panjab plains, Sindh, banks of the Nerbudda (Jacquemont). Common in ravines and dry water-courses in Rajputana and North Guzerat. Fl. Feb.-May. Bark dark-red brown, rarely cinereous, somewhat sulcate, but smooth and never speckled. The bark of the root is used in the distillation of spirits; the branches are cut, and leaves thrashed out with sticks to be used as fodder.

5. **A. eburnea**, Willd.; W. & A. Prodr. 276.—Syn. *Mimosa eburnea*, Roxb. Pl. Cor. t. 199; Fl. Ind. ii. 558. Vern. *Marmat*, Dekkan.

A large shrub or small tree. Branchlets hairy or glabrous, armed with straight spines, often ivory-white, and 1-2 in. long. Pinnæ 2-4 pair; common petiole ½-1 in. long, with a large cup-shaped gland at the insertion of the uppermost pair, and often another gland below the lowest pair. Leaflets 6-8 pair, small, oblong; petioles and leaflets often ciliate with long hairs. Peduncles axillary, solitary or several, bearing globose, golden-yellow flower-heads, with a pair of membranous bracts below the middle. Corolla tubulose; paleæ cuneate, ciliate. Flowers with a somewhat unpleasant smell. Pods generally 2-4 at the apex of the peduncle, from one flower-head, narrow-linear, 2-5 in. long, ¼ in. broad, slightly contracted between the seeds. Seeds 8-12.

East flank of Suliman range, ascending to 3000 ft., rarely to 5000 ft., rare in the Salt range. Outer Himalaya, as far east as Kamaon. Rocky beds of ravines in Oudh (R. Th.) Sindh, Oujein, the Dekkan, and South India. Also in Afghanistan, and at Aden. Generally found in dry, barren places. Fl. Nov.-Jan.; fr. May, June. Generally a shrub, at times a small tree 14-15 ft. high, with erect trunk, stiff divaricate, scrubby branches, and sparse greyish foliage. Bark dark grey or reddish brown.

6. **A. leucophlæa**, Willd.—**Tab. XXVII.**—W. & A. Prodr. 277; Bedd. Fl. Sylv. t. 48.—Syn. *Mimosa leucophlœa*, Roxb. Cor. Pl. t. 150; Fl. Ind. ii. 558. Vern. *Reru, raunj, karīr, nīmbar*, North India; *Rīnga, rīnj, reunja, rohani, jhind*, C.P.; *Arinj, areinj* (*Khejra* in South Meywar, near Bassi and Sadri), Rajputana; *Raundra, runjra*, Banswara; *Jhand*, Jallander Doab, and about Delhi; *Hewar*, South. Mar. country.

A thorny tree, branchlets, petioles, leaves, and branches of inflorescence grey-tomentose. Armed with strong, straight stipular spines. Common petiole 1-2½ in. long; pinnæ 5-12 pair; small, circular, cup-shaped glands generally at the insertion of each pair. Leaflets 12-30 pair, linear. Flowers pale yellow, nearly white, in globose heads, on short peduncles, arranged in large terminal, leafless panicles; two membranous bracts on the peduncle. Pods linear, 4-6 in. long, ⅓ in. broad, solitary, or 2-3 on one peduncle, clothed with short brown tomentum. Seeds 8-12.

Plains of the Panjab from Lahore to Delhi. Siwalik hills, between the Jumna and Ravi. Bandelkhand, Rajputana, the Satpura range, Khandeish, and South India. Ceylon, Burma, and Java. Young leaves in April. Fl. Aug.-Nov., sometimes as early as May; fr. Nov.-April.

Attains in places a considerable size, 6 ft. girth, with a crooked, gnarled trunk. Near Amritsar a specimen 15 ft. girth, and 80 ft. high, is said to have been found. Trunk generally taller than that of *A. arabica*, branches ascending, less numerous. On the dry hills of Mairwara, near Todgarh (normal rainfall about 12 in.), this is a thorny shrub or small tree, with 2-4 pair of pinnæ, and 8-10 pair of leaflets.

Bark thin, cinereous, yellowish, or light brown, with few deep narrow, longitudinal fissures, and short shallow cross-cracks, smooth between. Inner substance dark brown. Sapwood whitish, open, porous, and coarse-grained; heartwood small, reddish or dark purple, with darker wavy, concentric streaks, close- and fine-grained. Seasons well, and takes a fine polish, but is somewhat brittle. Strong and tough, but often eaten by insects. Skinner gives the weight of seasoned wood 55, of green wood 62 lb., and the value of P. 860. An excellent fuel for locomotives.

The bark is ground and mixed with flour during times of scarcity. In South India the bark is largely used in the preparation of spirits from sugar and palm-juice, and it is added on account of the tannin it contains, in order to precipitate the albuminous substances of the juice. The right of collecting the bark is often farmed out. By steeping the bark in water for 4-5 days, and beating it, a tough fibre is made, used for making nets and coarse cordage.

Large woody excrescences are often formed on the branches, somewhat resembling those of *Prosopis spicigera*, but more spongy in structure. Young pods are used as vegetables, and the seeds are ground and mixed with flour.

7. **A. rupestris**, Stocks; Boissier Fl. Orient. ii. 638.—Vern. *Khor*, Sindh; *Kūmta*, Rajputana.

A small thorny tree, 6-12 ft. high, branchlets and petioles pubescent. Armed with 3 infra-stipular prickles, the 2 lateral straight, the third recurved, all shining brown, compressed, and decurrent. Leaves 1-2 in. long; pinnæ 3-5 pair; petiole armed with numerous whitish prickles, with a gland below the lowest pair, and between the end pair of pinnæ. Leaflets grey, linear, ciliate. Spikes lax, 3-5 in. long, on short peduncles.

Flowers fragrant. Calyx green, teeth short, triangular, corolla and filaments white. Anthers lemon-yellow. Pod thin, flexible, pubescent when young, brown when ripe, sub-dehiscent, thickened at the edges, veined on the surface, linear-oblong, 3 in. long, ¾ in. broad. (The specimens collected in Rajputana are without prickles on the petioles.)

Dry rocky hills of Sindh, Northern Aravalli hills, near Kishengarh, Todgarh, and Bednor. In flower and fruit in Dec. 1869 (D.B.) Bark smooth, yellowish grey, wood light yellow, heavy and hard, with small irregular masses of black heartwood in the centre. Takes a beautiful polish. Used for weavers' shuttles. Exudes gum, which is collected in Sindh, and sold with that of *A. arabica*.

Another species, with 3 infra-stipular prickles and an armed petiole, but with a short broad pod 2 in. long, is *A. hamulosa*, Benth. l. c. 509. Aden and Arabia.

8. **A. modesta,*** Wall. Pl. As. rar. t. 130; Jacqu. Voy. Bot. t. 56; Boissier Fl. Orient. ii. 638.—Syn. *A. dumosa*, W. & A. Prodr. 274. *Mimosa dumosa*, Roxb. Fl. Ind. ii. 559, and probably *M. obovata*, Roxb. ib. 561. Vern. *Palosa*, Afg.; *Phala*, *phalāi*, *phulāhi*, Pb.

A thorny, moderate-sized tree, rarely unarmed, with grey foliage. Glabrous, a few scattered hairs on petiole and peduncle. Armed with twin, strong, shining dark-brown conical infra-stipular prickles. Leaves pale grey or glaucous; pinnæ 2-3 pair; leaflets 3-5 pair, obliquely oblong or obovate. Common petiole 1-2 in. long, a small round gland below the lowest pair of pinnæ. Stipules minute, deciduous. Flowers white or pale yellow, sweet-scented, nearly sessile, in lax, cylindrical, drooping spikes, the spikes solitary or 2-3 together, 1-2 in. long, on slender peduncles. Petals connate beyond the middle. Pod stalked, flat, indehiscent, linear-oblong, 2-3 in. long, ½ in. broad. Seeds 3-5, compressed.

Trans-Indus, in places abundant, in the plains and on the east flank of the Suliman range, ascending to 4000, and at times to 4500 ft. Common in the Salt range, and in the northern part of the Panjab plains, extending to Saharanpur and Delhi. Sub-Himalayan tract and outer hills between Indus and Sutlej, ascending to 3000 ft. Afghanistan. Leaves change in March. Fl. March, April, the white flower-spikes contrasting elegantly with the delicate green colour of the young foliage; but the flowers fade soon, and the leaves turn into an ash-grey colour. Fr. autumn; the pods remain on the tree for months.

25-30 ft. high, trunk short, at times 10-12 ft. girth; branches stiff, divaricate, forming a bushy, rounded crown. Branchlets drooping. Bark rough, with a multitude of irregular narrow cracks. Sapwood large, coarse-grained, somewhat glossy on a longitudinal section. Heartwood dark brown, nearly black, close-grained, compact and heavy. Stewart found the cub. ft. of seasoned wood to weigh 53.4 to 56 lb., and of green wood 69.5 to 76 lb. Strong and durable, prized for cart-wheels, sugar-cane crushers, ploughs, teeth of harrows, and Persian water-wheels. A tasteless gum exudes from wounds in the bark. The leaves and fallen blossoms are collected for cattle-fodder.

The tree is readily raised from seed, and answers admirably for hedges. Its growth is slow, much slower than that of Sissoo or Kikar.

9. **A. ferruginea,** DC.; Bedd. Fl. Sylv. t. 51; W. & A. Prodr. 273.—

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* I retain Wallich's as the safer name, being supported by his excellent figure and description, for the identity of the tree with *A. dumosa*, W. & A., might possibly be doubted.

Syn. *Mimosa ferruginea*, Roxb. Fl. Ind. ii. 561. Vern. *Kaiger*, Panch Mehals.

A large tree, with rough, dark-coloured bark; glabrous, armed with twin, short, infra-stipular prickles, rarely unarmed. Common petiole 3-6 in. long, common and secondary petioles with thickened base; glands small, circular or linear at the base of the upper pairs of pinnæ, and 1 below the pinnæ; leaflets oblong-linear, grey or glaucous, 15-30 pair; pinnæ 4-6 pair, 2-3 in. long. Flowers pale yellow, in lax, axillary spikes, 4-5 in. long, the spikes often numerous, and sub-paniculate near the ends of branches. Calyx about ½ the length of corolla, with short triangular teeth. Pods glabrous, light or dark brown, 3-4 in. long, flat, thin, indehiscent, nearly 1 in. broad.

South India, the Konkan, Mundlaisir, and forests of the Panch Mehals in Guzerat. Fr. Jan., Feb. Bark strongly astringent, used, like that of *leucophlœa*, in the distillation of arrack (Bedd.) Heartwood reddish brown.

The tree in the Panch Mehals was identified by Mr Dalzell, in his list of the P.M. trees, April 1863, with *A. Verek*, Guillemin et Perrotet, Fl. Senegambiæ, t. 56, a tree, which forms large forests north of the Senegal river, extending to the edge of the desert; is also found in Nubia and Kordofan, and yields some of the best kinds of gum-arabic. But *A. Verek* has (generally) a third infra-stipular prickle. The prickles have a broad decurrent base, and the leaves are smaller and hairy.

10. **A. lenticularis**, Hamilton; Benth. l. c. 508.

A small tree; perfectly glabrous, armed with twin infra-stipular prickles, or unarmed; leaves large glaucous; common petiole 3-6 in. long; pinnæ 2-3 pair; leaflets 6-8 pair, about 1 in. long, obovate or oblong, obtuse. Flowers sessile, in axillary spikes, 3-5 in. long; corolla more than twice the length of calyx. Legume linear, flat, membranous, indehiscent, 6-9 in. long, 1 in. broad.

Siwaliks of Kamaon, Rajmahal hills. Reported from the Central Provinces, but I have not seen specimens. This is probably "*Khyn*" of Madden, Journ. As. Soc. xvii. I. 570, "an armed tree with the blossoms of the *Khyr* and the fruit of the *Siris;* wood excellent. Forests about Burmdeo and Punagiri."

11. **A. Catechu**, Willd.—Syn. *Mimosa Catechu*, Linn. Suppl. 439; Roxb. Cor. Pl. t. 175. *M. Sundra*, Roxb. l. c. t. 225. *Acacia catechuoides*, Benth. *A. Sundra*, DC.; Benth. l. c. 510. *A. Sandra*, Bedd. Fl. Sylv. t. 50. Vern. *Khair*, *kheir*, *Kher*. (*Shaben*, Burm.)

A moderate-sized tree, with thorny branches and rough dark-coloured bark. Branchlets and petioles generally dark-brown or purple, glabrous, shining; below the insertion of each leaf a pair of compressed, sharp, brown, shining, infra-stipular prickles. Common petiole 3-4 in. long, often armed with scattered prickles, a gland below the lowest pair of pinnæ, and at the insertion of the 3-4 uppermost pairs. Pinnæ 10-20 pair; leaflets numerous, linear, imbricate, glabrous or pubescent, less than ¼ in. long, generally turning brown in drying. Spikes lax, axillary, cylindrical, pedunculate, 2-4 in. long, solitary or fascicled, flowers pale yellow, sessile. Petals linear, connate at the base, 2-3 times longer than calyx. Pods stipitate, thin, brown, shining, 2-3 in. long, ½-¾ in. broad, seeds 3-10.

Common in most parts of India and Burma. Apparently not indigenous in Sindh, but common in the Aravalli hills, and in the sub-Himalayan tract, extending west to the Indus, and ascending to 3000 ft. in the valleys. Ceylon, and Eastern Africa. Generally gregarious in the sub-Himalayan tract, on islands, and the banks of rivers near their entrance into the plains. Fl. May-July; fr. autumn; the pods remain long on the tree. The old leaves are shed in Feb.-March; the new foliage appears March-April.

30-40 ft. high, trunk short, not very straight, 4-6 ft. girth, attaining 10 ft. Branches straggling, thorny; foliage light, feathery. When cut or lopped it is often reduced to a low-tangled shrub, with long, thorny branches. Bark ½-¾ in. thick, dark grey, or greyish brown, in old trees nearly black, rough and exfoliating in long narrow strips or scales. Inner bark reddish, fibrous. Sapwood large, yellowish white; heartwood dark red, extremely hard, annual rings indistinct. Medullary rays numerous; pores uniformly distributed, each surrounded by a patch of lighter-coloured tissue. Cunningham determined the weight of wood grown in Gwalior at 70.2 lb., the value of P. resulting from his experiments is 779. Of wood grown in the Central Provinces, the weight is given as 75.4 (R. Th.), (76.5 unseasoned), and 79.2 (Centr. Prov. List). These last figures are high, and the question naturally arises whether the woods were really seasoned. From Burma two varieties are mentioned in my list of Burma woods (1862), Nos. 29 and 30, weighing 56 and 70 lb. respectively. There is thus still some uncertainty regarding the weight of the wood of this tree, and this uncertainty is increased by the confusion which has hitherto existed in the nomenclature of this and the allied species. Skinner's list does not contain *A. Catechu*, but he describes two woods which he calls *Acacia Suma* (*Tella Sundra*, Telugu), weight 77, P. = 801, and *Acacia Sundra* (*Nulla Sundra*, Telugu), weight 81, P. = 915. R. Thompson gives the weight of *A. Sundra* (from the Centr. Prov.) at 60 lb. seasoned, and 81 lb. green. I do not venture to decide to which of the species here described these specimens belonged. The wood seasons well, takes a fine polish; the sap is apt to be eaten by insects; the heartwood is exceedingly durable, even more so than Teak. It is not attacked by white ants, and not touched by Teredo navalis. It is used for rice-pestles, sugar-cane and oil-seed crushers, cotton-rollers, wheel-wright's work, ploughs, bows, spear- and sword-handles. In Burma it is preferred to all other woods for house-posts. In North India it is considered to yield the best charcoal for blacksmith's work. The bark is very astringent, rather bitter, in places used for tanning. The most valuable product of the tree, however, is Catechu (*Katha*). The heartwood is cut into chips, which are boiled in water in earthen pots, the red solution is poured off, and boiled again over fresh chips, and after this has been repeated several times, it is boiled down in large round flat iron bowls to the thickness of a black paste, which, when dry, is the Cutch of commerce, a heavy compact mass, with a shining dark-brown or black fracture. In this manner Cutch is manufactured in Pegu, and the preparation of it in India is similar. Pale Catechu is a more earthy substance of dull reddish colour. Madden (l. c. 565) describes the *Katha* made in Kamaon as crystallising on leaves and twigs thrown into the concentrated liquor. Cutch or Catechu is a most valuable article, extensively consumed in the East with the Betel-leaf, and largely exported to Europe for dyeing and tanning. It is bitter and very astringent, and is used medicinally (Pharm. Ind. 62).

12. **A. Suma**, Kurz. MSS.—Syn. *Mimosa Suma*, Roxb. Fl. Ind. ii. 563; Ill. in Herb. Kew, t. 1867; *Acacia Catechu*, Benth. l. c. 510; Bedd. Fl.

Sylv. t. 49. Vern. *Sai-kanta*, Beng.; *Kumtia*, Pertabgarh; *Dhaula khejra* (white Acacia), Banswara. *Gorādo*, Mandevi; *Son kairi*, Dangs.

A large tree with white bark. Branches flexuose, branchlets and petioles downy with whitish or grey soft pubescence. Below the insertion of each leaf a pair of sharp conical infra-stipular prickles, downy while young, brown shining afterwards. Common petiole 4-10 in. long, unarmed, a large cup-shaped gland, oval, and often $\frac{1}{10}$ in. long near the base, or half-way between the base and the first pair of pinnæ; smaller circular glands at the insertion of the upper 3-10 pair; pinnæ 10-20 pair; leaflets numerous, linear, $\frac{1}{4}$ in. long, imbricate or approximate, pubescent and ciliate, grey or greyish green when dry. Flowers pale yellow, sessile, in lax, axillary, cylindrical, pedunculate spikes, often interrupted at the base. Petals more or less cohering beyond the middle, less than twice the length of calyx. Peduncles and calyx downy with soft grey pubescence. Spikes 2-4 in. long, generally fasciculate, and paniculate at the ends of branches. Pods stipitate, thin, 2-4 in. long.

South India (common in Mysore, between Shemoga and Bangalur), Bengal, Guzerat, extending north to Banswara and Pertabgarh (D.B., 1870). Fl. May-Aug. Large conical thorns on the white bark. Heartwood red, catechu made of it. Bark (in Pertabgarh) peeled off and used for tanning.

There is considerable confusion in the synonyms of these two species. For the first, which is the most generally distributed Catechu-yielding Acacia, and is readily distinguished by the dark-coloured bark, I maintain Willdenow's name, *Acacia Catechu*, as he quotes (iv. 1079), t. 175, of the Corom. Plants, and I unite with it *A. catechuoides*, Benth., which does not appear to me to be specifically distinct. For the second species, with white-coloured bark, Mr Sulpiz Kurz has, I understand, adopted Roxburgh's name *Suma*, which to me also seems the most appropriate. The excellent description of the Flora Indica is supported by the admirable manuscript-drawing quoted above. This species I do not know from North India. Mr R. Thompson notes, besides *A. Catechu*, *A. Sundra*, from Oudh and the Central Provinces; this may be *Suma*, but unfortunately I have not seen his specimens. I do not venture to identify Willdenow's *A. polyacantha* with *Suma*, nor do I feel sure which species are meant by *A. Catechu* and *Sundra* of Wight and Arnott's Prodromus. In Beddome's Fl. Sylv. t. 49, *A. Catechu* (*Suma*) is said to have a dark-brown bark, but this error is corrected in p. xcv of the Manual.

13. **A. concinna**, DC.; W. & A. Prodr. 277.—Syn. *Mimosa concinna*, Willd.; Roxb. Fl. Ind. ii. 565. Vern. *Ailah*, *rassaul*, Oudh; *Ban-ritha* (forest soap-nut), Beng.; *Sikikāi*, *sikekāi*, Dekkan.

A large climbing and prickly shrub; branchlets, petioles, and peduncles tomentose or pubescent, and armed with numerous scattered sharp recurved prickles. Common petiole 3-4 in. long, with a gland below the first pair of pinnæ, and 1 or 2 glands at the insertion of the uppermost pairs. Pinnæ 4-6 pair; leaflets 12-20 pair, linear, from a rounded, unequal-sided base, $\frac{1}{4}$-$\frac{1}{2}$ in. long, glabrous or ciliate when full grown. Stipules large, semicordate, striate. Flower-buds purple; flowers yellow, in globose heads. Calyx and corolla thinly membranous, pubescent. Ovary pubescent all over, or with a few isolated hairs. Flower-heads on slender peduncles 1-1$\frac{1}{2}$ in. long, fasciculate, forming racemose panicles at the ends of branches. Pods thick, fleshy, imperfectly dehiscent, somewhat contracted between seeds, 4-5 in. long, 1 in. broad.

South India, Bengal, Burma, Indian Archipelago. Abundant in the Oudh forests. Fl. March-July; the fr. ripens in the ensuing cold season. The pods (and in Oudh the pounded leaves also) are used for washing the hair. The leaves are acid, and are eaten.

A. rugata, Ham.; Benth. l. c. 514 (ovary villose), does not in my opinion differ from *A. concinna*. In the specimens of both *concinna* and *rugata* examined by me, the ovaries are always more or less hairy, and this is the main character given. I follow Wight and Arnott in maintaining the name *A. concinna* for the united species.

14. **A. cæsia**, W. & A. Prodr. 278.—Syn. *Mimosa cæsia*, Linn.; Roxb. ii. 565. *Acacia Intsia*, Willd.; W. & A. Prodr. l. c.; Benth. l. c. 515. Vern. *Katrar*, Kamaon.

A large climbing and prickly shrub; branchlets, petioles, and peduncles pubescent, and armed with short, conical, sharp, scattered prickles. Branchlets and petioles angled and sulcate. Common petiole 3-12 in. long, with oblong, raised convex glands, one above its base, and 2 or 3 smaller glands at the base of the uppermost pinnæ; pinnæ 4-15 pair; leaflets 10-30 pair, subcoriaceous, pubescent, shining above, pale or rust-coloured beneath, subfalcate or from an oblique base linear-oblong, acute. Stipules deciduous, linear or lanceolate, striate. Flower-buds brown or greenish white; flowers pale yellow, in globose pedunculate heads. Peduncles fasciculate, in large terminal panicles. Pods thin, flat, dehiscent, 4-6 in. long, 1 in. broad; rusty, or brown-tomentose when young, glabrous afterwards.

Common in most parts of India and Burma. In the sub-Himalayan tract to the Chenab, ascending to 4000 ft. in Kamaon. Fl. April-Aug.; the pods ripen in autumn.

15. **A. pennata**, Willd.; W. & A. Prodr. 277.—Syn. *Mim. pennata*, Roxb. Fl. Ind. ii. 565. Vern. *Agla*, *awal*, Kamaon.

Differs from *A. cæsia* by narrow linear leaflets, not pale beneath, a large flat raised oval gland half-way between the base of the common petiole and the first pair of pinnæ, and glabrous pods.

South India, Bengal, Burma, Indian Archipelago. Nepal, Kamaon, and Oudh forests. Fl. June-Aug.

ORDER XXXII. ROSACEÆ.

Herbs, shrubs, or trees, with alternate, rarely opposite, simple or compound, stipulate leaves, and regular flowers. Calyx superior or inferior, gamosepalous; lobes 5, the 5th next the axis, imbricate in bud. Disc annular, or lining the calyx-tube. Petals 5, rarely none, perigynous, often orbicular and concave, deciduous, imbricate, claws short or none. Stamens numerous, rarely 1 or few, inserted with the petals or on the disc, 1- to multiseriate, incurved in bud; anthers small, usually didymous. Carpels 1 or more, free or connate, or adnate to the calyx-tube;

styles as many, free or connate; ovules 1 or 2, usually collateral in each carpel, rarely more. Fruit various, a pome, or one or many drupes achenes or follicles, rarely a berry or capsule. Albumen scanty or none; cotyledons plano-convex, radicle short.—Gen. Pl. i. 600; Royle Ill. 201; Wight Ill. i. 199.

- Ripe carpels not enclosed within the calyx-tube.
  - Carpel 1. Fruit a drupe.
    - Style terminal; drupe with a hard, bony stone . . . 1. PRUNUS.
    - Style basal; drupe with a coriaceous endocarp . . . 2. PRINSEPIA.
  - Carpels many, fruit of many small drupes . . . . 3. RUBUS.
- Ripe carpels enclosed within the calyx-tube.
  - Carpels many, 1 pendulous ovule in each. Fruit of many free achenes enclosed in the fleshy calyx-tube . . . 4. ROSA.
  - Carpels 1-5; ovules 2 collateral in each carpel; fruit fleshy, 1- 2- or 5-celled.
    - Fruit 2-5-celled; cells with cartilaginous walls . . . 5. PYRUS.
    - Fruit a drupe, with 1-5 included stones . . . . 6. CRATÆGUS.
    - Fruit a drupe, with 3-5 bony half-exserted stones . . . 7. COTONEASTER.
    - Fruit a drupe, including a 5-celled, dehiscent capsule with crustaceous valves . . . . . . 8. STRANVÆSIA.

1. PRUNUS, Linn.

Shrubs or trees with alternate, simple, glandular-serrate leaves; petioles with 2 glands. Flowers white or red, solitary, corymbose or racemose. Calyx deciduous. Petals 5. Stamens 15-39, perigynous; filaments free. Carpel 1; style terminal; ovules 2, collateral, pendulous. Drupe with an indehiscent or 2-valved, 1-seeded, smooth or rugged stone. Seed pendulous; testa membranous; albumen scanty or none.

- Flowers fasciculate, umbellate, or solitary.
  - Pericarp tough, dry, fibrous; flowers before the leaves . 1. *P. Amygdalus.*
  - Pericarp a soft fleshy pulp.
    - Flowers solitary or twin, appearing before or with the leaves.
      - Leaves oblong-lanceolate, conduplicate in bud . . 2. *P. persica.*
      - Leaves cordate or ovate, convolute in bud . . 3. *P. armeniaca.*
      - Leaves ovate or ovate-lanceolate, convolute in bud . 4. *P. communis.*
    - Flowers fasciculate or umbellate, appearing after the leaves.
      - Calyx turbinate; leaves glabrous . . . . . 5. *P. Cerasus.*
      - Calyx long-tubular; leaves white-tomentose beneath . 6. *P. prostrata.*
    - Flowers umbellate, appearing before the leaves . . 7. *P. Puddum.*
- Flowers in racemes or corymbs.
  - Leaves oblong; flowers in long drooping racemes . . 8. *P. Padus.*
  - Leaves ovate; flowers in pedunculate corymbs . . 9. *P. Mahaleb.*

1. **P. Amygdalus**, Baillon Histoire des plantes, i. 415.—Syn. *Amygdalus communis*, Linn.; Roxb. Fl. Ind. ii. 500; Boissier Fl. Orient. ii. 641. *The Almond-tree.* Vern. *Badām.*

A moderate-sized, deciduous, glabrous tree, with light-green foliage, greyish when full grown. Leaves oblong-lanceolate, conduplicate in bud, serrulate; petiole glandular, as long as the greatest width of leaf, or longer. Stipules subulate, fimbriate. Flowers white, tinged with red, appearing before the leaves, on short peduncles, twin or solitary, from scaly buds on last year's wood. Calyx campanulate. Drupe velvety, pericarp dry, separating into 2 valves when ripe. Stone compressed, with shallow wrinkles and minute holes. Cotyledons large, plano-convex, filled with oil; albumen none.

Cultivated in Afghanistan and Persia, whence large quantities of (sweet and some bitter) almonds are brought to India. Also in Kashmir and the plains of the Panjab. Indigenous on the Anti-Lebanon, in Kurdistan, the Caucasus (doubtfully), and in Turkestan. Naturalised in Greece and North Africa. Hardy in England, where it flowers in February. In the Panjab the fruit is scanty, and not good. The Almond was known to Theophrastus and other classical writers.

2. **P. persica,** Benth. & Hook. fil.—Syn. *Amygdalus Persica,* Linn.; Roxb. Fl. Ind. ii. 500. *Persica vulgaris,* Mill; Boissier Fl. Orient. ii. 640. The *Peach* with velvety, and *Nectarine* with smooth fruit.—Vern. *Ghwareshtāi,* Afg.; *Aru, aōr, chinannu, beinni, beimu,* Pb.; *Aru,* N.W.P.

A moderate-sized, deciduous tree, with dark-green foliage; glabrous. Leaves oblong-lanceolate, conduplicate in bud, serrate, petiole with 2-4 glands, or without glands, shorter than greatest width of leaf; stipules subulate, fimbriate. Flowers rose-coloured, appearing before or with the leaves, sessile, from scaly buds on last year's wood. Calyx campanulate. Drupe downy or smooth, with a tender succulent sapid pericarp, the stone deep and irregularly furrowed. Cotyledons large, plano-convex, filled with oil; albumen none.

Commonly cultivated in the Himalaya from the Indus to Sikkim, also Trans-Indus, in the plains of the Panjab, the Dekkan, in Afghanistan, Western Asia, Europe, and China. It is certainly naturalised in the N.W. Himalaya, and is often found apparently wild. In the same way it has been found in North Persia and in Transcaucasia, but it seems more probable that the peach-tree is originally indigenous in China, where its cultivation has been traced back to the tenth century B.C. Into South Europe it was introduced from Persia about the commencement of the Christian era. Hardy in England. In the N.W. Himalaya it is grown at different elevations, in Kunawar up to 10,000, and in Lahoul to 9000 ft. Fl., according to elevation, between January and May, the fruit ripening between May and October. The foliage turns red before it is shed.

The tree is grown for its fruit, which is an important article of food. The blossom is apt to be killed by frost, and a small green beetle at times strips the tree of its leaves. The wood of trees past bearing is used for building and other work; the heartwood is brown, compact, even-grained, and smooth to work.

3. **P. armeniaca,** Linn.; Roxb. Fl. Ind. ii. 501.—Syn. *Armeniaca vulgaris,* Lam.; Boissier Fl. Orient. ii. 652. *The Apricot.* Vern. *Hārī, gardālu, jaldāru, shīran, cheroli, cherkush, serkuji, shāri,* Pb. hills; *Iser,* Kashmir; *Zardālu,* Pb. plains; *Chūāri, zardālu,* N.W.P. Himalaya.

A moderate-sized, deciduous tree. Nearly glabrous, petioles of young leaves pubescent. Leaves convolute in bud, broadly ovate, nearly as broad as long, acuminate, crenate; petiole glandular, half the length of leaf; stipules lanceolate. Flowers pinkish white, solitary or fasciculate, appearing before or with the leaves from scaly buds on the previous year's wood; peduncles generally short, included in buds. Calyx campanulate. Drupe downy or smooth, with a tender, succulent, sapid pericarp, the stone smooth, with a thickened sulcate margin.

Commonly cultivated between Indus and Sarda, in the N.W. Himalaya, in the plains of the Panjab, in Afghanistan, Western and Central Asia, Europe, and

China. Hardy in England. In the Himalaya the fruit ripens well up to 10,000 ft., but it is best between 6000 and 9000 ft. In West Tibet the tree is cultivated as high as 12,000 ft.: at that elevation, however, the fruit seldom ripens properly. Believed to be indigenous in the Caucasian region, and to have been introduced into Europe about the same time as the Peach-tree. Often found seemingly wild in the N.W. Himalaya. Fl. Jan.-May, according to elevation, the fruit ripens between June and Sept. The foliage turns yellow in August, and becomes red before falling.

Attains 30-35 ft. and 5-6 ft. girth; crown close, spreading, rounded. In the N.W. Himalaya the dried apricots form a considerable portion of the food of the people, particularly during autumn and winter. In the apricot districts—for instance, on the Sutlej, Tonse, and Jumna—the roofs of all houses are covered with the yellow fruit in the season, spread out to dry. The dried fruit is an important article of trade, and is imported into the plains from the hills, and from Afghanistan. Oil is extracted from the kernels, which is burnt, used in cooking, and for the hair. The heartwood of the apricot is reddish, and is much used for various ordinary purposes. *P. dasycarpa*, Ehrh., the Black Apricot, a variety with dark purple velvety fruit, is cultivated in Kashmir, Afghanistan, Beluchistan, and in Europe.

4. **P. communis**, Hudson; Hook. Stud. Fl. 106.—Vern. *Alūcha, olchi, er, aor, gardālu*, Pb.

A shrub or moderate-sized tree, unarmed or spinescent; extremities pubescent. Leaves convolute in bud, ovate, or ovate-lanceolate, serrate, more or less pubescent along the nerves beneath; petioles shorter than greatest breadth of leaf. Stipules linear, fimbriate. Flowers on slender pedicels, 3 or 4 times the length of calyx-tube, from lateral often leaf-bearing buds. Pedicels solitary or in pairs, buds often approximate. Drupe globose or oblong.

I follow Bentham (Handbook of the Brit. Flora, i. 236) and Hooker in uniting the Sloe, the different kinds of plums, damsons, and prunes under one species. The principal sub-species are the following:—

a. *P. spinosa*, Linn.; Boissier l. c. 650.—*Sloe, black-thorn*. A shrub with divaricate spinescent branches, bark black; pedicels solitary or in pairs, glabrous; drupes erect, small, globose or sub-globose. Europe, North Africa.

b. *P. insititia*, Linn.; Boissier l. c. 651.—*Bullace*. A shrub with straight branches, sometimes spinescent, branchlets velvety; leaves pubescent beneath; pedicels in pairs, downy; drupes middle-sized, globose, ¾-1 in. diam., drooping. Europe, North Africa.

c. *P. domestica*, Linn.; Boissier l. c. 652.—*Plum, prune*. A tree, unarmed, branchlets glabrous; pedicels in pairs, pubescent; drupes large, oblong, drooping.

d. *P. divaricata*, Ledebour; Boissier l. c. 651.—Syn. *P. cerasifera*, Ehrh.? A small tree, unarmed, rarely spinescent, branchlets glabrous, pedicels solitary; leaves whitish-villous beneath at the nerves or at the midrib only; drupe yellow, globose, or ovoid. Macedonia, Caucasus, North Persia.

I do not venture to decide to which sub-species the Kashmir plum belongs. The drupe is nodding, globose or ovoid, ¾ in. long; the branchlets are glabrous, the leaves woolly beneath, with long hairs half-way up the midrib; the pedicels are solitary or in pairs from one bud, but appear fasciculate because several flower-bearing buds (shortened branchlets) are often approximate. It is cultivated for its fruit, which is very palatable, in Kashmir at 5000-7000 ft., at places in the Panjab plains, and in Afghanistan. The wood is light or dark reddish-brown, smooth to work. In Kashmir the skeleton of the so-called Papier-maché boxes is made of it. About Almora two kinds of plum are cultivated, one a dark-blue damson (*Bhotiya badam*), ripens in July, the other (*Ladakh*) orange-red, much larger, and ripens in June (Madden As. Soc. Jour. xvii. pt. I. 445).

The cultivation of plums and prunes in Europe is very old, probably as old as that of pears and apples. Plinius mentions a large number of varieties (ingens turba prunorum). Some of the better kinds, however (*damascena*), were brought from Syria.

5. **P. Cerasus,** Linn.; Hook. Stud. Flora 107. Cherry.—Vern. *Gilās, olchi, krusbal,* Pb. Him.

An unarmed shrub, or moderate-sized tree; glabrous or nearly so. Leaves conduplicate in bud, elliptic or obovate, abruptly acuminate, irregularly crenate-serrate; petiole less than the breadth of leaf, 2 glands on the edge of leaf near base, or on the petiole; stipules linear or subulate, fimbriate. Flowers white, on long slender peduncles in fascicles of 2-5, from lateral generally leaf-bearing buds. Calyx turbinate, lobes obtuse. Drupe smooth, sweet or acid, with a polished round stone.

I follow Bentham l. c. 237, and Hooker, in classing the sweet and acid Cherries as one species. The following are commonly accepted as the distinctive characters of the two sub-species.

a. P. Avium, Linn.; Boissier Fl. Orient. ii. 649. A tree, without root-suckers; leaves flaccid, drooping, hairy beneath, petiole with 2 glands. Flower-bearing buds leafless, peduncles drooping; calyx-tube contracted at the mouth, lobes entire, subacute; fruit sweet. Indigenous in Europe and North Africa.

b. P. Cerasus, Linn.—Syn. *Cerasus caproniana,* DC.; Boissier l. c. 649. A shrub, or small tree, numerous suckers from the root; leaves subcoriaceous, firm, shining, erect, no glands on petiole. Flower-bearing buds leaf-bearing, peduncles stiff; calyx-tube not contracted at the mouth, lobes serrate, obtuse. Fruit acid, naturalised in Europe, indigenous in Western Asia. It must have been a variety of the acid cherry which was introduced to Rome by Lucullus. Sweet cherries were cultivated in Italy before his time.

Several varieties of cherries are cultivated in Kashmir, Bussahir, and elsewhere in the North-West Himalaya, generally between 5000 and 8000 ft.; some are also found in a seemingly wild state. Fl. April-May. In Kashmir the fruit ripens in June. A moderate-sized tree, with short trunk, and a rounded dark-green crown. The bark flakes off in horizontal belts.

6. **P. prostrata,** Labillardière; Sibth. Fl. Græca t. 478.—Vern. *Tāra, ter, talle,* Pb., Him.

A small scraggy shrub, 5-6 ft. high; branchlets hoary. Leaves ovate or oblong, sharp-serrate, narrowed into short petiole, glabrous above, densely clothed with white woolly tomentum beneath; petiole without glands. Flowers red, on short peduncles, appearing with the leaves, generally twin from lateral buds. Calyx-tube cylindrical, pubescent or glabrous outside, teeth short, obtuse, hairy inside. Fruit ovoid or subglobose, $\frac{1}{3}$ in. long, reddish purple when ripe, with scanty pulp.

North Afghanistan frequent between 11,000 and 12,000 ft. Common in the arid parts of the North-West Himalaya. Kashmir (5000-7000 ft.), Chenab (7500-8500 ft.), Lahoul (10,000 ft.), Ravi, rare (7500-8500 ft.), Sutlej (8000 ft.).

Also in Persia, on the Caucasus, Taurus, in Asia Minor, Syria, Crete, Greece, Sardinia, Spain, and Algeria. Fl. Apr. Hardy in England. In dry rocky places, with stiff, divaricate, often procumbent branches. Bark reddish brown or blackish, longitudinally rugose, a smooth white pellicle peeling off. The fruit is eaten.

This sp. might be identified with *P. Cerasus Griffithii*, Boiss. Fl. Or. ii. 648, but the characters separating *Griffithii* from *prostrata*, solitary flowers and glabrous calyx-tube in the latter, do not seem to be constant.

7. **P. Puddum**, Roxb. MSS.—Syn. *P. sylvatica*, Roxb. Fl. Ind. ii. 501; *Cerasus Puddum*, Wall. Pl. As. rar. t. 143. Sans. *Padmaksh*. Vern. *Chamiāri*, *amalgūch*, *pāja*, *pajja*, Pb.; *Paddam*, *padm*, *pāya*, N.W.P.

A handsome moderate-sized tree, with glossy green leaves; nearly glabrous. Leaves ovate, long-acuminate, sharply and often duplicate-serrate, 3-5 in. long, petioles ½ in., with 2-4 large glands near base of leaf. Stipules palmately 3-5-fid, the divisions lanceolate, glandular-fimbriate. Flowers white or pink, appearing before the leaves, on slender pedicels as long as flowers, or somewhat longer, often branched, in umbellate fascicles crowded near the ends of branches. Calyx turbinate, with ovate acute lobes. Stigma stellate, 3-lobed. Fruit in pendulous clusters, yellow and red, ovoid or globose, ½-⅔ in. long, acid, and somewhat astringent when ripe; kernel ovoid, rugose and furrowed.

Wild, and frequently cultivated in the Himalaya and the Doons, from the Indus to Sikkim, generally at elevations between 2500 and 7000 ft. Kasia hills. Fl. Apr.-May, sometimes in autumn. Madden states (Bhimtāl in Kamaon), "The flowers appear in Oct.-Nov., and are soon succeeded by the leaves. In January the leaves are beset by myriads of aphides, which distil great quantities of honeydew* over them;" and adds that the tree is evergreen at Almora, and ripens its fruit in spring. Trunk short, 4-5 ft. girth. Bark brownish grey, smooth, peeling off in flakes. Wood reddish brown, hard, strong, and durable, used for walking-sticks and bludgeons. Fruit acid and astringent, not much eaten or valued.

P. Pseudocerasus, Lindl., China, Japan, is nearly related to *C. Puddum*. Two other species belonging to the same group as the Cherry and Puddum are found in the North-West Himalaya. 1. *P. humilis*, Bunge, called *Reis*, *she*, *būnarāla*, *rapori*, *talle*, in the Panjab Himalaya, is a small glabrous shrub, with brownish-grey bark, ovate-lanceolate, coriaceous, deep- and sharp-serrate leaves, fimbriate, and often bifid stipules, which is found between 7000 and 12,000 ft. in the more arid parts of the North-West Himalaya, from the Chenab to the Jumna, also in North China, and is supposed to be the wild form of *Prunus japonica*, Thunb., several varieties of which are cultivated in Japan on account of their beautiful white or pink, often double, blossoms. 2. *P. tomentosa*, Wall., found in Kashmir by T. Thomson, between 5000 and 6000 ft., is remarkable on account of its softly-tomentose, ovate leaves, and an ovoid, acuminate, nearly sessile fruit. It is similar to *P. tomentosa*, Thunb., a shrub or small tree, wild in North China, and cultivated in gardens in Japan, with sessile scarlet fruit; valued in Japan as a remedy against dysentery (Sieb. Zucc. Fl. Jap. p. 53 t. 22).

8. **P. Padus**, Linn.; Hook. Stud. Fl. 107.—Syn. *Cerasus Padus*, Boissier Fl. Orient. ii. 650. *Cerasus cornuta*, Wall.; Royle Ill. t. 38, f. 2. Bird Cherry. Vern. *Pāras*, *kālakāt*, *gīdar-dāk*, *bart*, *zūm*, *zam*, *zambu*, *jamu*, *jamui*, *chūle*, *dūdla*, *krūn*, Pb.; *Jāmana*, Kamaon.

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* The honeydew is possibly a secretion of the leaves, which attracts the aphides.

Nearly glabrous; young branchlets, inflorescence, and axils of nerves on the underside of leaves pubescent. Leaves conduplicate in bud, oblong or obovate, greatest width generally above the middle, acuminate, serrate, slightly cordate at the base; stipules linear, early deciduous. Flowers white in lax racemes, appearing after the leaves, 3-8 in. long at the end of short lateral, often leaf-bearing branches. Bracts linear, caducous. Stamens 25-30. Drupe globose, ⅓ in. long, red first, then dark purple or nearly black.

Himalaya, between 4000 and 10,000 ft., at times ascending to 12,000 ft., from the Indus to Sikkim. Occasionally planted. A widely-spread tree, from North and Central Europe through Siberia to Amur land and Kamtchatka. Caucasus and Western Asia. Deciduous, the mature foliage dark green, turning red before its fall, generally in autumn, sometimes as early as June. Fl. April-June to Sept. Fr. usually ripens July-Oct., remains long hanging on the tree.

Usually found in mixed forests; thrives best in moist places, where it attains 50 to 60 ft., with a girth of 5-6 ft. Bark ⅛ in. thick, brown or purple, fairly smooth, a scurfy tuberculate grey pellicle peeling off. Wood brownish white, close- and even-grained, takes a fine polish. In France it is occasionally used by cabinet-makers. The fruit is sour, with a slight mawkish astringent flavour, but is much eaten by the hill people. In Sweden and Lapland, and some parts of Russia, the bruised fruit is fermented, and a spirit distilled from it. The unripe fruit of this species is often attacked by an insect, and then swells out into a curved horn-like excrescence; hence Wallich's name of *P. cornuta.* Similar excrescences are often found on Plum-trees in Europe, particularly on prunes (*Zwetschen*) in Germany. The leaves are considered excellent cattle-fodder.

A small tree, resembling *P. Padus*, with coriaceous, oblong-lanceolate leaves, and numerous short lateral racemes, 2-4 in. long, and 10-20, generally 15 stamens, is *P. capricida*, Wall., in the Himalaya, between 6500 and 8000 ft., from the Jumna to Bhutan, and in the Kasia hills.

9. **P. Mahaleb**, Linn.—Syn. *Cerasus Mahaleb*, Boissier Fl. Orient. ii. 649. French, *Bois de Ste-Lucie.* German, *Weichsel Kirsche.*

A small deciduous, glabrous tree. Leaves ovate, obtusely serrate; petioles ⅓ or ½ the length of leaf. Flowers fragrant, on lateral, pedunculate, corymbose racemes on the previous year's wood, lower pedicels 1 in. long and longer. Drupes ovoid, compressed, ¼ in. long.

Cultivated at Kelat in Beluchistan (Stocks). Wild in Western Asia, on the Caucasus. Wild or naturalised in South and Central Europe. The scented kernels are sold as medicinal in the bazaars of Sindh and South India. (On the Rhine, as far north as Altenahr and the Drachenfels.) The wood of the European tree is prized on account of its fragrance, hardness, and the fine polish it takes. Tobacco-pipe tubes and snuff-boxes are made of it. It is believed that this tree was introduced from the East into Europe simultaneously with the Horse-chestnut tree. Hardy in England.

2. PRINSEPIA, Royle.

A shrub with lanceolate, serrate leaves and bisexual flowers. Calyx persistent, tube cup-shaped, with 5 unequal, rounded lobes, imbricate in bud. Petals 5, inserted at the mouth of calyx, rounded, short-clawed. Stamens numerous, inserted with petals, multiseriate, with short filaments;

anther-cells separated by a broad connective. Carpel 1, sessile, with 2 pendulous, collateral ovules. Drupe oblique, oblong-cylindrical, fleshy, with a coriaceous 1-seeded kernel. Remains of style at the base of the drupe.

1. **P. utilis**, Royle; Ill. t. 38 f. 1.—Vern. *Bekkar*, *bekkra*, *bekkli*, *bhekal*, *bhigal*, *bekala*, *karanga*, N.W. Him. Local names: *Gurinda*, Hazara; *Tatūa*, *phūlwāra*, Rajaori; *Jīnti*, Chenab; *Cherara*, *dhatela*, *jhatela*, Gharwal, Kamaon.

Nearly glabrous, youngest branchlets only pubescent. Leaves coriaceous. Axillary spines often leaf-bearing. Flowers white in short axillary racemes, generally from the outside base of the spines. Drupes purple, seeds oily.

Common on dry rocks at elevations between 2000 and 9000 ft. in the outer Himalayan ranges from Hazara to Bhutan. Also on the Kasia hills. Generally in flower in autumn, in fruit in spring. From the seeds oil is expressed, used as food, and for burning. The pith of stem and branches is large, and in drying separates into thin horizontal layers. Wood close-grained.

3. **RUBUS**, Linn.

Trailing shrubs or creeping herbs, almost always prickly. Leaves alternate, simple or compound, the stipules more or less adnate to the petiole. Flowers white or red, in terminal or axillary corymbose panicles, rarely solitary. Calyx broadly cup-shaped, deeply cleft into 5 persistent lobes. Petals 5. Stamens numerous. Carpels many, on a convex receptacle; style subterminal; ovules 2, collateral, pendulous. Drupes many, 1-seeded, crowded on a dry or spongy conical receptacle.

Leaves simple, lobed . . . . 1. *R. paniculatus.*
Leaves tri- or quinque-foliolate, rarely unifoliolate.
  Petiole of terminal leaflet less than half the length of common petiole; fruit black . . . . 2. *R. fruticosus.*
  Petiole of terminal leaflet more than half the length of common petiole; fruit yellow . . . . 3. *R. flavus.*
Leaves imparipinnate, rarely trifoliolate.
  Flowers in lax corymbose panicles; petals red, shorter than calyx-lobes; fruit white-tomentose when unripe, black when ripe; leaflets 2-5 pair . . . . 4. *R. lasiocarpus.*
  Flowers often axillary; petals white, as long as calyx-lobes; fruit oblong, red when ripe; leaflets 1-3 pair . . 5. *R. rosæfolius.*
  Flowers axillary; petals white, as long as calyx-lobes; fruit subglobose red or deep orange; leaflets 1-2 pair . . 6. *R. biflorus.*

1. **R. paniculatus**, Sm.; DC. Prodr. ii. 567 (not Roxb. or Schlechtendal).—Syn. *R. tiliaceus*, Sm. (probably). Vern. *Kāla ākhi*, Kangra. *Anchu*, *pattarola*, *kala hisālu*, Kamaon, Garhwal.

A shrub, armed with few, short, scattered prickles; branchlets, inflorescence, and underside of leaves clothed with dense soft grey silky tomentum. Leaves from a cordate, rarely entire rounded base, broad-ovate, acuminate, longer than broad, serrate, more or less lobed with 3 or 5 prominent basal nerves. Stipules and bracts linear or oblong, often cleft at the top, or half-way down, into linear segments. Flowers on long slender pedicels, in lax, spreading terminal panicles. Calyx-segments ovate-lanceolate, long-acuminate, longer than the white petals. Fruit blackish purple.

Common in many parts of the Himalaya from Hazara to Sikkim, between 3000 and 8000 ft. Kasia hills. Fl. April-June.

Nearly related to this species are two other brambles with white flowers and entire, lobed leaves, marked by pectinate stipules and bracts, deeply cleft, often nearly to the base, into linear segments; *R. reticulatus*, Wall., from the higher ranges (7000 to 10,000 ft.) in Kamaon and Sikkim, grey tomentose, with leaves reticulate beneath, generally broader than long, and compact cylindrical panicles; and *R. rugosus*, Sm. (*R. Hamiltonianus*, Wall. Pl. As. rar. t. 234), from Nepal and the Eastern Himalaya, the mountains of Burma, Ceylon, and South India (on the Ghats as far north as Mahableshwar), rusty tomentose, with leaves rugose above, and finely reticulate beneath, ovate calyx-segments, and red fruit.

2. **R. fruticosus**, Linn.; Hook. Stud. Fl. 109. Blackberry, Bramble. —Vern. *Ankri, ālish, ālach, kanāchi, chench, pakhāna.*

A large shrub, armed with few recurved compressed prickles. Branches more or less angular. Branchlets, inflorescence, and underside of leaves canescent, or clothed with short grey tomentum. Leaves trifoliolate on flower-bearing, and often quinquefoliolate on leaf-bearing branches; leaflets oval or obovate, irregularly serrate; petiole of terminal leaf less than half the length of common petiole. Stipules linear. Flowers in compact cylindrical panicles; calyx reflexed. Fruit more or less hemispherical, black when ripe.

Afghanistan, Waziristan, Peshawar valley, and further south in the trans-Indus territory. Salt range 1500-3000 ft. Common in Hazara, Rajaori, Kashmir, as far as the Ravi, generally between 2000 and 6000 ft. This is a tomentose form of the common Blackberry, a widely-spread species in Europe, Siberia, West Asia, and North Africa. Of the numerous European forms of the Blackberry, *R. discolor*, Weihe et Nees, Deutsche Brombeer sträucher, t. xx.; Engl. Bot. t. 447; Boissier Fl. Orient. ii. 695, is probably most nearly allied to the Himalayan variety. Fl. April-June; fruit ripens Sept.-Oct.

3. **R. flavus**, Ham.—Syn. *R. Gowreephul*, Roxb. Fl. Ind. ii. 517; W. & A. Prodr. 298; Wight Ic. t. 231. *R. ellipticus*, Sm. (*R. Wallichianus*, W. & A. Prodr. 298, Wight Ic. t. 230 (= *R. hirtus*, Roxb.), does not seem to differ from this species). Vern. *Akhi, ānkri, kunāchi, gurācha, pukāna*, Pb., Him.; *Esar, hishālu, hisālu*, Garhwal, Kamaon.

A large shrub with long trailing branches, armed with copious long reddish bristles and sharp curved prickles. Branchlets, inflorescence, petioles, and underside of leaves clothed with soft grey or tawny tomentum. Leaves trifoliolate, those at the base of branchlets often unifoliolate; leaflets elliptical or rotundate, sharp-serrate, often acuminate, the terminal largest; midrib of terminal leaflet forming an angle with petiole. Petiole of terminal leaflet often forming an angle with, and generally exceeding half the length of common petiole. Flowers white, in axillary fascicles and in broad compact rounded terminal panicles; pedicels short or long, slender. Calyx-segments broadly ovate, striate. Petals cuneiform, obovate, twice the length of calyx. Fruit yellow.

Himalaya, from the Indus to Bhutan. Kasia hills, mountains of South India. In the N.W. Himalaya and Siwalik tract, at elevations between 1500 and 8000 ft. Fl. March; fruit ripens April, May.

4. **R. lasiocarpus**, Sm.; W. & A. Prodr. 299; Wight Ic. t. 232.—Syn. *R. racemosus* and *albescens*, Roxb. ii. 519; *R. mysorensis*, Heyne.—Vern. *Gunācha*, *pagūnāi*, *pukāna*, Hazara; *Kandiāri*, *kharmuch*, *sūrganch*, *gurācha*, Kashmir; *Tūlanch*, Chenab; *Niū*, *kalliāchi*, Bias; *Kālawar*, *kala hisalu*, Garhwal, Kamaon.

A spreading shrub, with long stems, rooting at the extremities, armed with few straight or curved sharp prickles. Branches round, often purple, glabrous, or pruinose, rarely with glandular hairs. Leaves canescent or white-tomentose beneath, imparipinnate; leaflets 2-5 pair, ovate or ovate-lanceolate, with large serratures, the terminal leaflet often lobed. Flowers on long slender pedicels, in lax corymbose panicles. Inflorescence and calyx white-tomentose; petals red, shorter than the ovate-lanceolate calyx-lobes. Fruit white-tomentose when unripe, black when ripe.

Abundant throughout the Himalaya, the Kasia hills, the mountains of Burma, South India, and Ceylon. In the North-West Himalaya, and in the Siwalik tract, at elevations between 2000 and 8000 ft. Rare in the Peshawar valley, probably brought down by the rivers. Fl. March, April; fruit ripens June, July. Fruit very good to eat. Hardy in England.

5. **R. rosæfolius**, Sm.; DC. Prodr. ii. 556.—Syn. *R. rosæflorus*, Roxb. ii. 519; *R. pungens*, Cambess. in Jacqu. Bot. t. 59. Vern. *Kanāchi*, Hazara, Khagan; *Yeshul*, Kamaon, Garhwal.

A spreading shrub, armed with straight and curved prickles, glabrous, or with glandular hairs. Leaves imparipinnate, leaflets 1-3 pair, lanceolate, deep and irregularly serrate or lobed; stipules lanceolate. Flowers on long slender pedicels, axillary, or in lax terminal corymbs. Calyx-lobes ovate-lanceolate, long-aristate, ½-1 in. long, as long as, or a little shorter than, the large white petals. Fruit oblong, or cylindrical, red when ripe.

Himalaya from Hazara to Assam. Kasia hills. Java, China, Japan. In the North-West Himalaya between 5000 and 10,000 ft. Often cultivated with double flowers, var. *coronarius*.—Bot. Mag. t. 1783.

6. **R. biflorus**, Buch.; DC. Prodr. ii. 558; Bot. Mag. t. 4678.—Vern. *Chānch*, *kantunch*, *khaniāra*, Kashmir; *Karer*, *akhreri*, *akhe*, Ravi.

A large spreading shrub, armed with scattered sharp prickles, subulate from a broad base, the branches covered with a white pruinose coating, which is easily rubbed off. Leaves imparipinnate, leaflets generally 1 pair only, ovate-lanceolate, deep- and irregularly serrate, the terminal leaflet often lobed; stipules lanceolate. Flowers white, on long slender pedicels, solitary, or in fascicles of 2 or 3 in the axils of the upper leaves; calyx-lobes ovate-lanceolate, shortly aristate, as long as petals. Fruit drooping, subglobose, red or deep orange, sweet.

Himalaya from Hazara to Bhutan. North-West Himalaya from 4000-10,000 ft. Fl. April, May. Hardy in England.

Two other species are common in the North-West Himalaya :—*R. niveus*, Wall., at 7000 to 11,000 ft., from Kashmir to Bhutan ; leaves trifoliolate, sometimes imparipinnate, with broad ovate leaflets, the terminal leaflet often lobed ; long subulate stipules ; calyx-segments often more than ½ in. long, much exceeding the small red petals ; and red or yellowish brown fruit : *R. macilentus*, Camb. in Jacq. t. 60, Kashmir to Sikkim, between 5000 and 8000 ft., with 3 ovate-lanceolate leaflets, often 1 only, white petals as long as calyx, and bright yellow fruit.

4. **ROSA**, Linn.

Erect scrambling or climbing shrubs, more or less prickly, with imparipinnate leaves, serrate leaflets and stipules more or less adnate to the petiole. Flowers terminal, solitary corymbose or paniculate. Calyx-tube persistent, globose urceolate or ovoid, mouth contracted, limb divided into 5 foliaceous segments. Disc coating the calyx-tube. Petals 5, rarely 4. Stamens numerous, inserted on the edge of disc, at the mouth of calyx-tube. Carpels free below, many, rarely few, enclosed in the calyx-tube, the styles protruding from the tube, and occasionally united. When in fruit, the carpels are dry, hairy, 1-seeded achenes, enclosed in the more or less succulent calyx-tube, the whole forming a dry or pulpy red or black berry.

Styles united in a column as long as stamens ; flowers white	1. *R. moschata.*
Styles distinct ; flowers yellow	2. *R. lutea.*
Styles distinct ; flowers pink, red, or white.	
Branches armed with prickles and bristles ; petals 4	3. *R. sericea.*
Branches armed with prickles only ; petals 5.	
Leaves ½-2½ in. long ; leaflets 7, obovate or rotundate	4. *R. Webbiana.*
Leaves 2-8 in. long ; leaflets 7-11, elliptical	5. *R. macrophylla.*

Numerous species are cultivated in India. Those more generally grown—without, however, any reference to garden varieties and hybrids—may be classed as follows, the groups being partly taken from Lindley's Rosarum Monographia, London, 1820, partly from Boissier's Fl. Orientalis, ii. 669. The characters given are those commonly assigned to each species, but cultivation and crossing have created such a multitude of forms, that in many cases it is impossible to recognise any satisfactory specific distinctions.

A. STYLES DISTINCT.

I. *Bracteatæ.* Fruit and branchlets clothed with dense persistent woolly tomentum ; flowers bracteate ; prickles twin, mostly infra-stipular.

1. *R. involucrata*, Roxb. Fl. Ind. ii. 513 ; Wight Ic. t. 234. Flowers subsessile, large, white, fragrant, surrounded by large pectinate, woolly bracts. Indigenous in Bengal and the Eastern Himalaya.

2. *R. Lyellii*, Lindl. l. c. t. 1. Flowers pedunculate, large, white or blush ; bracts linear, hoary, entire. Indigenous in Nepal, Kamaon, and on Mt. Aboo.

3. *R. bracteata*, Wendl. ; Redouté les Roses, i. 35. Flowers large, white, solitary, surrounded by 8-10 ovate imbricate, finely pectinate bracts. China—*Macartney's rose*, with double fl., believed to belong to this sp.

II. *Eglanteriæ.* Prickles scattered, of two kinds, some slender, setaceous, others stout, straight, or curved ; flowers yellow or red ; calyx-lobes persistent in fruit.

4. *R. lutea*, Mill. (see below).

5. *R. sulphurea*, Aiton. Flowers large, yellow, always double ; leaflets 7,

glabrous above, whitish and slightly pubescent beneath. Native country not known. Said to have been brought to Constantinople from Persia in the sixteenth century (C. Koch Dendrol. i. 226). *R. Rapini*, Boiss. l. c. 672—Asia Minor, Armenia, North Persia—a yellow rose similar to *R. sulphurea*, may possibly be its wild form.

III. *Gallicæ*. Erect shrubs; prickles scattered, mixed with bristles, which are mostly glandular; leaflets generally 5, rarely 7, ovate or oval, rugose, more or less pubescent beneath; flowers solitary, or in few (5-15) flowered corymbs, rose-coloured or purple; calyx-segments more or less pinnatifid. Scent very delicate. The commonly accepted 3 species of this section are probably not specifically distinct.

6. *R. damascena*, Mill. (*Golab, sudburg.*) Prickles unequal, the larger ones falcate; sepals reflexed during flowering. Native country unknown. The rose most generally cultivated in India. Attar (otto) of roses is made principally from the flowers of this species. Also called *R. Calendarum*, because the time of flowering extends over several months.

7. *R. centifolia*, Linn. *Cabbage rose, Moss rose, Provence rose.* Prickles unequal, the larger falcate glandular, bristles numerous; leaflets and calyx glandular-ciliate; flowers nodding. Caucasus, mountains of Assyria. Fl. June, July (Europe).

8. *R. gallica*, Linn. Prickles equal, slender; flowers erect. South and Central Europe, Asia Minor. Fl. June, July (Europe).

IV. *Caninæ*. Prickles uniform, no bristles. Flowers white or rose-coloured.

9. *R. indica*, Linn.; Lindl. l. c. 106.—Syn. *R. chinensis*, Jacquin; Roxb. Fl. Ind. ii. 513; Koch l. c. 273. *R. sinica*, Linn. Glabrous, evergreen; stipules very narrow, adnate nearly to the apex; flowers large, double, half double, rarely single, white yellow pink red or purple, on long slender pedicels; calyx-segments reflexed. Indigenous in China, but early brought to India. The *Indian* (*China* or *Bengal*) roses have a powerful scent, by no means so delicate as that of the *Gallica* group: their flowering time extends over a great part of the year. To this species belong *Rosa fragrans*, Redouté, the Tea Rose, yellow, very fragrant; *R. semperflorens*, Bot. Mag. t. 284; Roxb. Fl. Ind. ii. 514, with dark-red flowers,—and numerous other varieties. *R. Noisetteana*, Red. l. c. ii. p. 77, the Noisette Rose, is a cross of this and *R. moschata*. The large host of *Hybrid Perpetuals* are chiefly derived from *R. indica*.

10. *R. microphylla*, Lindl. Bot. Reg. t. 919; Roxb. Fl. Ind. ii. 515; Bot. Mag. t. 3490. Branchlets flexuose, prickles infra-stipular; leaflets 9-15, small, subcoriaceous. Calyx densely clothed with long subulate prickles; segments short, broad-ovate, dentate. Flowers solitary, or 2-3 together, large, double, pale rose-coloured. Indigenous in China. Not quite hardy in England.

11. *R. alba*, Linn.—Syn. *R. glandulifera*, Roxb. Fl. Ind. ii. 4 (?) A tall spreading shrub, prickles scattered, straight or falcate, somewhat unequal, but no bristles. Foliage grey, leaflets 5-7, large, rugose; downy and very pale beneath. Fl. large, often double, mostly corymbose, white, or of a delicate blush colour, calyx segments often pinnatifid. Probably indigenous in the Caucasian region, and possibly wild in Afghanistan and N.W. India. Nearly allied to *R. canina*, Linn., the common English *Dog rose*.

V. *Banksianæ*. Scandent or climbing; stipules small, subulate, nearly free, often deciduous; leaflets 3 or 5, rarely more. Flowers corymbose, not very large.

12. *R. Banksiæ*, R. Brown.—Syn. *R. inermis*, Roxb. l. c. 516. *Lady Banks' Rose;* Bot. Mag. t. 1954; Bot. Reg. t. 1105. No prickles; leaflets 3 or 5 shining; flowers small, corymbose, white or yellow. China, Japan.

13. *R. microcarpa*, Lindl. l. c. t. 18. Armed with curved prickles; leaflets 3, rarely 5, shining. Flowers white, corymbose; calyx deciduous. Fruit small, globose, red. China.

14. *R. sinica*, Aiton; Lindl. l. c. t. 16; Bot. Reg. t. 1922. Armed with scattered, red, falcate prickles. Leaflets 3, shining. Flowers solitary, large, white; peduncles and calyx-tube thickly covered with straight prickles or bristles. Fruit orange-red, muricate, crowned with the spreading rigid sepals. China, Japan.

15. *R. Fortuniana*, Lindley; Paxton Flower-Garden, ii. 71. Armed with small falcate prickles. Leaflets 3 or 5, dark green, shining; flowers solitary, white, double on short, setose peduncles. Calyx-tube perfectly glabrous, without prickles or bristles. China.

B. STYLES UNITED IN A COLUMN EXSERTED BEYOND THE CALYX-TUBE.

VI. *Systylæ.* Flowers numerous, in terminal corymbs; prickles uniform; leaflets 2-3 pair.

16. *R. moschata*, Mill. (see below).

17. *R. sempervirens*, Linn.; Bot. Reg. t. 465.—Syn. *R. Leschenaultiana*, Redouté Roses, iii. 87; W. & A. Prodr. 301; Wight Ic. t. 38. Climbing, prickles scattered, curved from a broad base, generally red. Leaves evergreen, glabrous, shining; stipules and bracts narrow, glandular, ciliate; petioles, peduncles, and outside of calyx-tube with glandular bristles. Flowers white; calyx-segments ovate, acuminate, densely pubescent inside, deciduous; fruit small, orange-coloured. South Europe, North Africa, East Himalaya, Kasia hills, mountains of South India.

18. *R. multiflora*, Thunb.; Bot. Reg. t. 425. Stipules and bracts linear-oblong, pectinate, with linear segments. Flowers double, blush red; petioles, peduncles, and calyx-tube pubescent, with long soft hairs without glands. Calyx-segments broad-ovate, shortly acuminate. Japan, China.

1. **R. moschata**, Mill.; Bot. Reg. t. 829.—Syn. *R. pubescens*, Roxb. Fl. Ind. ii. 514; *R. Brunonii*, Lindl. Monogr. Ros. t. 14. Vern. *Kūji, kūju, kajei, karer*, N.W. Himal.; *Phūlwāri, chal*, Kashmir; *Kwia, kwiala*, Kamaon.

Climbing young shoots and underside of leaves pubescent, branches armed with a few stout recurved prickles. Leaflets 2-3 pair, nearly sessile, ovate-oblong, acuminate, 1-3 in. long. Flowers white, 1½ in. across, in large compound terminal corymbs. Pedicels 1-1½ in. long, slender, pubescent, often with glandular hairs, but without bristles or prickles. Calyx-lobes long, narrow-acuminate, twice the length of ovary, often pinnatifid. Styles united in a hairy column, clavate above, as long as stamens or longer. Fruit dark brown, subglobose or ovoid, ¼-½ in. long.

North-West Himalaya, from Afghanistan to Nepal, ascending to 11,000 ft., commencing at 2000 ft. in the Panjab, and at 4000 ft. in Kamaon. Fl. May, June. Forms masses of thorny scrambling scrub, and climbs to the top of lofty trees, hanging down in elegant festoons. Cultivated in Europe (hardy in England), China, and throughout India, where it blooms all the year round, but chiefly during the cold season. Wild in North Africa, and naturalised in Spain.

2. **R. lutea**, Mill.; Bot. Mag. t. 363; Boissier Fl. Orient. ii. 671.—Syn. *R. eglanteria*, Linn.

A shrub; youngest branchlets pubescent, and armed with large and small prickles; petioles, stipules, and underside of leaves pubescent and glandular. Branches armed with pale, scattered, straight, nearly equal prickles and no bristles; root-shoots more densely armed. Leaflets 2-4 pair, elliptical or oblong-obovate, with deep, generally double and glandular serratures, more or less hairy and glandular beneath. Stipules adnate above the middle. Flowers yellow, solitary or 2 or 3 together, on pedicels ¾-1 in. long. Calyx-segments lanceolate hairy; apex dilated and often dentate or pinnatifid. Ovary and back of calyx-segments with scattered bristles. Disc thickened; styles villous, distinct.

Arid parts of the inner Himalaya. Lahoul, Ladak, Western Tibet between 8000 and 11,000 ft. In British Lahoul near villages only (Cleghorn). In Kishtwar at 7500 ft. (T. Thomson). Fl. June, July. Mountains of Afghanistan and Beluchistan. Naturalised in Central and South Europe. Hardy in England.

3. **R. sericea,** Lindl. Monogr. Ros. t. 12; Royle Ill. t. 42 f. 1.

Armed with large, shining, generally infra-stipular prickles ½-¾ in. long, from a broad, flat, triangular base, straight or slightly curved upwards. Copious small prickles and bristles. Leaves approximate; leaflets 3-5 pair, oblong oblong-obovate or cuneate, entire near the base, dentate near top with deep sharp teeth, glabrous above, silky, especially near nerves beneath. Stipules adnate beyond the middle, petioles pubescent. Flowers solitary, white or pink; peduncle and ovary glabrous. Calyx-segments broad-lanceolate, pubescent. Petals 4. Fruit scarlet, pear-shaped, crowned by the persistent calyx-segments.

Higher ranges of the outer and inner Himalaya, between 9000 and 14,000 ft. from the Chūr (Royle) to Bhutan. Fl. June. Hardy in England.

4. **R. Webbiana,** Wall.; Royle Ill. t. 42.—Vern. *Kāntiān, shingāri,* Hazara; *Shīkand, sikanda, shāwali, manyar, brāzen,* Chenab; *Chūa,* Lahoul; *Sia,* Ladak; *Sea,* Piti.

Erect shrub; glabrous, or petioles and leaves pubescent. Branchlets without bristles, armed with prickles of one size, straw-coloured, ¼-¾ in. long, on a large flattened base, straight or nearly so, divaricate or ascending. Leaves small, subcoriaceous, ½-2½ in. long; leaflets generally 3 pair, subcoriaceous, obovate or rotundate, entire near the base, with deep sharp teeth near the apex. Flowers pink, solitary or geminate; peduncles ½-¾ in. long. Calyx-segments twice the length of ovary, nearly as long as petals, lanceolate, long-acuminate, apex slightly dilated. Peduncles, ovary, and back of calyx-segments nearly always clothed with large, glandular hairs or bristles. Styles villous, distinct. Fruit ovoid or globose, ½ in. long, red, fleshy.

Chiefly in the arid tracts of the N.W. Himalaya from the Indus to Kamaon, generally between 5000 and 10,000 ft., ascending to 13,500 ft. in Ladak. On the south of the Safedkoh between 8000 and 9000 ft. The fruit is eaten. In Piti the branthes are collected and piled up on houses to be used as fuel. Hardy in England.

Nearly allied is the *Scotch* or *Burnet Rose, R. spinosissima,* Linn., sub-sp. *R. pimpinellifolia,* Hook. Stud. Fl. 120, of Europe and the East, which differs by more numerous leaflets (generally 4-5 pair), copious, slender, large and small prickles, the ovary and calyx-segments glabrous, calyx-segments shorter than petals, and a depressed globose fruit.

5. **R. macrophylla**, Lindl. Monogr. Ros. t. 6.—Syn. *R. Hoffmeisteri*, Klotsch, Reise des Prinzen Waldemar Bot. t. 7. Vern. *Gūlāb, gūlābi, bangūlāb.* Local names: *Jikjik*, Chenab; *Akhiāri*, Ravi.

Erect, often unarmed, pubescent, often with glandular hairs; prickles from a conical basis, long, straight, ¼-½ in. long, no bristles. Leaves 2-8 in. long; leaflets 3-5 pair, elliptical, the terminal 1-3 in. long, the others smaller. Petioles tomentose. Flowers red, 1½-2 in. across, solitary or in terminal corymbs. Bracts large, foliaceous. Pedicels 1 in. long, pubescent with glandular hairs and bristles. Calyx-lobes hoary or grey-tomentose, very long, longer than petals; base narrowly triangular, apex dilated, lanceolate, toothed. Styles pilose, exserted, distinct. Fruit large, soft, turbinate, 1 in. long.

Himalaya from Khagan to Sikkim. In the N.W. Him. between 3500 and 10,000 ft. Fl. May, June. Fruit eaten. Hardy in England.

5. PYRUS, Linn.

Trees or shrubs, with deciduous, simple or pinnate leaves. Flowers white or pink, in terminal corymbs. Calyx-tube urceolate, lobes reflexed or deciduous. Stamens many; filaments sometimes connate at the base. Carpels 2-5, adnate to the calyx-tube; styles free or connate below; ovules 2 in each cell (numerous in *P. Cydonia*). Fruit fleshy, 2-5-celled, cells with a cartilaginous or bony, often 2-valved endocarp, 1-2-seeded (except in *P. Cydonia*).

Leaves simple, flowers in simple corymbs.	
Fruit pyriform, not umbilicate at the base; styles free.	
Leaves rounded or ovate, simple; fruit smooth . . .	1. *P. communis.*
Leaves ovate-lanceolate, often lobed; fruit rough . .	2. *P. variolosa.*
Fruit umbilicate, globose, depressed; styles connate.	
Extremities white-tomentose; peduncle as long as fruit, or shorter	3. *P. Malus.*
Extremities glabrous; peduncles 3-4 times longer than fruit	4. *P. baccata.*
Leaves simple, entire; flowers solitary	5. *P. Cydonia.*
Leaves simple, lobed, or pinnatifid; flowers in compound corymbs	6. *P. Aria.*
Leaves pinnate; flowers in compound corymbs	7. *P. ursina.*

Carl Koch and Decaisne write *Pirus*, thus restoring the classical spelling of the word, changed for *Pyrus* in the sixteenth century. I follow Bentham, Boissier, and Hooker in retaining the spelling of Linnæus; because, if we were to commence altering the customary spelling of botanical names, the changes would be endless and confusion would be unavoidable.

1. **P. communis**, Linn.; Hook. Stud. Fl. 125; Boissier Fl. Orient. ii. 653. The Pear-tree.—Vern. *Tang, batang, batank, nāk, sunkeint, charkeint, lī*, Pb. Him.; *Nāshpāti, nāk*, Pb. plains.

A shrub or large tree, entirely glabrous, or extremities, young leaves, and inflorescence more or less pubescent or floccose; branchlets often spinescent in young trees. Leaves rotundate, ovate, or oblong-ovate, acute or short acuminate, entire or obtusely serrate; petiole slender, as long as leaf or nearly so. Flowers white, in short corymbs at the end of short, often leaf-bearing branchlets. Calyx-tube campanulate or turbinate, not much contracted at the mouth; limb spreading, divided down to the tube or nearly so into 5 lanceolate or triangular acute lobes. Petals clawed, rounded, obtuse, flat, twice as long as calyx, patent. Styles 5, free. Fruit more or less turbinate, not umbilicate at base, crowned with the persistent calyx.

Indigenous in Transylvania, South Russia, mountains of Asia Minor, the Caucasus, and North Persia. Believed to be indigenous in France, and other parts of Central Europe. Naturalised and often seemingly wild in England. Believed to be wild in Kashmir. Cultivated on account of its fruit throughout Europe, Western Asia, and in the North-West Himalaya, between 2000 and 8500 ft., ascending in Ladak to 10,000 ft. Fl. March, April; fr. July-Sept. Some good kinds are grown in Kashmir and Afghanistan, but generally the Himalayan pears are indifferent. Occasionally the tree is cultivated in the Panjab plains, and in other parts of India; the fruit is hard, but good for baking and stewing. At Calcutta it blossoms, but never sets fruit. The wood is only used for ordinary purposes, and is not valued. In Europe the wood is prized on account of its close and compact grain; it is used for engraving, turning, and mathematical instruments. Decaisne, in Jardin Fruitier du Museum (Le Poirier), 1871-72, i. 122, considers the Pears, comprising *P. communis, variolosa, syriaca,* &c., as different races only of one species.

2. **P. variolosa,** Wall.—Syn. *P. Pashia,* Don.; Decaisne Jardin Fruitier du Museum, Le Poirier, t. 7. Vern. *Tang, batangi, tāngi, shindar, kent, ban keint, katāri, kīthu, gād kīyi, ku, shegul,* Pb.; *Mēal, mehal, mol,* N.W.P.; *Passi,* Nepal.

A moderate-sized tree; extremities, underside of youngest leaves, inflorescence, and calyx clothed with dense white or yellow, floccose tomentum. Branchlets often spinescent. Leaves ovate or ovate-lanceolate from a rounded or slightly cordate base, often lobed or pinnatifid, long-acuminate, crenate, on slender petioles half the length of leaf or longer. Flowers white, slightly tinged with pink, on lateral cymose corymbs, at the end of short, often leaf-bearing branchlets. Calyx-tube urceolate, mouth contracted, limb spreading, white-hairy inside and outside, divided half-way down into 5 obtuse or acute ovate lobes. Petals obovate, rounded, with dark radiating veins. Fruit nearly globose when ripe, ¾-1½ in. diam., crowned with the base of calyx, blackish, rough, and scurfy, with numerous elevated round white spots. The ripe fruit by hanging gets yellowish russet-brown.

Common in many parts of the Himalaya from the Indus to Bhutan, at elevations between 2500 and 8000 ft. Occasionally cultivated. Also in the Kasia hills. Leaves and flowers March, April; fruit ripens Sept.-Dec.; fl. occasionally in autumn. Hardy in England. 20-35 ft. high, trunk short, rarely exceeding 5 ft. girth, crown oval, not very close. Bark dark-coloured, with some whitish spots, and shallow longitudinal furrows. Wood brown, compact, fine-grained, hard and durable, not easily attacked by insects. Walking-sticks, combs, tobacco-tubes, and various implements made of it. The fruit is never eaten, until like a Medlar it is half rotten, and even then is harsh, not sweet. A form with glabrous pedicels and rotundate calyx-lobes from Kamaon is described by Decaisne (l. c. under *P. Pashia*) as *P. Kumaoni;* and another, with glabrescent, not verrucose fruit, from the Panjab, is figured on tab. 8 of the same work as *P. Jacquemontiana.*

3. **P. Malus,** Linn.; Hook. Stud. Fl. 125.—Syn. *Malus communis,* Desf.; Boissier Fl. Orient. ii. 656. *The Apple-tree.* Vern. *Shewa,* Afg.; *Shū, sho, cho, (amru)sun, seo, chūnt, khajir, bisīr, palu,* Pb., Himalaya; *Kūshū,* Ladak; *Seo, seb,* North India.

A moderate-sized tree, rarely exceeding 30 ft.; extremities, underside of leaves, and inflorescence clothed with white silky tomentum, rarely glabrous. Leaves ovate, acuminate, obtusely serrate; petiole about half the length of leaf or shorter. Flowers white, tinged with red, in umbelliform corymbs, at the end of short lateral leaf-bearing branchlets. Stamens about 20. Styles 5, connate. Fruit umbilicate at base, globose, more or less depressed, crowned with the remains of the calyx.

Indigenous in Greece, Macedonia, Asia Minor, the Caucasus, and Persia. Common in woods and hedges, and believed to be wild in England, Ireland, and the greater part of Central and South Europe. Apparently wild in the North-West Himalaya, between 5000 and 9000 ft. Cultivated on account of its fruit throughout Europe, temperate Asia and North America, and the Himalaya, ascending to 9000, in Ladak to 11,400 ft. The apple-tree is grown in gardens in Sindh, the plains of the Panjab, the Dekkan, Tirhūt, and Chota Nagpur, and in many places produces good fruit. In Lower Bengal it blossoms, but does not set fruit. Fl. March-May; fr. July-Sept. The wood is used for ordinary purposes.

The cultivation of the apple and pear in Greece and Italy is very old, and there seems no doubt that both trees are indigenous in South and Central Europe.

4. **P. baccata,** Linn.; Koch Dendrologie, i. 210. *The Siberian Crab.*—Vern. *Baror, liū, lhījo, līwar,* Pb. Him.; *Ban mehal, gwālam,* N.W.P., Him.

A small, nearly glabrous tree, with short trunk and a rounded crown of dark-green foliage. Leaves elliptic, acuminate, sharply serrate; petiole longer than half the leaf. Flowers white, in umbelliform corymbs, on long, slender peduncles, at the end of short leaf-bearing branchlets. Calyx-tube glabrous or slightly pubescent outside, urceolate, limb spreading, with lanceolate deciduous lobes, as long as calyx-tube or longer, white cottony inside. Petals with dark veins. Styles 3-5, nearly free, woolly at the base. Fruit red or scarlet, small, globose, umbilicate; peduncles 2-4 times the length of the fruit.

Himalaya, not uncommon, from near the Indus to Kamaon, generally between 6000 and 10,000 ft., in Piti to 11,000 ft. Cultivated occasionally on the Chenab. Outside India in Japan and Siberia. Fl. spring; fr. Aug.-Nov. Hardy in England. Bark greyish brown, thick, tough, traversed by deep cracks, not unlike the bark of some coniferous trees. The fruit is small and sour, but palatable, with a true apple flavour, and is much prized by the hill people. Wood brownish white, even, compact, fairly hard.

5. **P. Cydonia,** Linn.—Syn. *Cydonia vulgaris,* Pers. Boissier Fl. Orient. ii. 656. *Quince.* Vern. *Bihi,* North India; *Bamtsūnt, bumsūtu,* Kashmir.

Extremities, underside of leaves, inflorescence, and calyx white-tomentose. Leaves ovate, obtuse at the base, entire, on short petioles. Stipules oblong, obtuse, glandular-serrate. Flowers large, white, 2 in. across, on short peduncles, solitary, or a few together at the end of short leaf-bearing branchlets. Calyx-lobes leafy, oblong-lanceolate, glandular-serrate, reflexed, longer than calyx-tube. Fruit pyriform, clothed with grey or yellow, woolly tomentum, 5-celled; cells cartilaginous, many-seeded. Seeds covered with mucilaginous pulp.

The Quince is cultivated in Afghanistan, Beluchistan, Persia, Sindh, the Panjab plains, and the North-West Himalaya, ascending to 5500 ft., also in Western Asia and Europe. Wild or apparently wild in Greece, Thracia, the Caucasus, Armenia, and North Persia (Boissier). According to C. Koch, Dendrol. i. 220, the original home of the Quince is not known. Like other pomaceous trees and shrubs, it springs up readily from self-sown seed, and has thus established itself in many localities. In the Panjab the fruit ripens in June and July. Hardy in England.

6. **P. Aria**, Ehrh.; Hook. Stud. Fl. 126.—Syn. *P. Kumaonensis*, Wall.; *P. vestita*, Wall.; *P. lanata*, Don.; *Sorbus Aria*, Crantz; Boissier Fl. Orient. ii. 658. Vern. *Gūn palos*, Afg.; *Doda*, *chola*, *chilana*, *maila* (*tang*), *paltu*, *ban pāla*, *kanghi*, *thānki*, *morphal*, *marpol*, Pb., Him.; *Galion*, *māuli*, *paltu*, *banpalti*, N.W.P., Him.

A moderate-sized tree. Extremities, inflorescence, underside of leaves, and calyx clothed with white woolly tomentum. Leaves 3-5 in. long, ovate or obovate, coarsely serrate, and generally lobed, with 6-12 pair of prominent lateral nerves, each terminating in an acute lobe. Petiole ½-1 in. long. Flowers white, odorous, ½ in. diam., in terminal compound corymbs. Fruit red, ½-1 in. long, turbinate, or globose, crowned with the persistent calyx-lobes, 2-8-celled, cells 1-seeded, endocarp brittle.

Common in many parts of the Himalaya, between 5000 and 10,000 ft., from the Indus to Bhutan. Also in Afghanistan, Europe, North Africa, Siberia, and Western Asia. Fl. Apr.-May; fruit Aug.-Oct. Branchlets brown, with white specks, larger branches often white, bark of trunk reddish or dark-brown, with shallow, longitudinal wrinkles. The tree is readily known by the white underside of leaves, the abundant white blossoms, and the showy red fruit. Wood light-coloured, compact. Fruit eaten when half rotten. In Europe, *P. Aria* is an exceedingly variable species, varying with undivided, lobed, and pinnatifid leaves, and divided by many botanists into several species.

The common Medlar, P. (Mespilus), *germanica*, Linn., with spinescent branchlets, oblong-lanceolate leaves, large solitary white flowers, and 5-celled fruit, with a bony endocarp, the cells 1-seeded, is wild in Western Asia, Greece, and Thracia, naturalised in the rest of Europe, but has not yet been found in the Himalaya.

7. **P. ursina**, Wall.—Vern. *Sūlia*, *hūlia*.

A shrub or small tree. Buds, inflorescence, petioles and underside of leaflets along nerves hispid with long, generally rusty hairs. Leaves 4-6 in. long, imparipinnate; leaflets 8-12 pair, opposite, sessile, oblong, the middle ones longer than the upper and lower, 1-1½ in. long, cuspidate-serrate. Flowers greenish white, unpleasant-smelling, in compound corymbs, terminal, and from the axils of the uppermost leaves, with long linear, rusty-pilose bracts. Calyx cup-shaped, glabrous, cleft half-way into acute, triangular segments. Petals rusty-villous when young. Ovary hairy; styles 2-5, thick. Fruit ovoid, globose or turbinate, ½ in. diam. or less, crowned with the persistent calyx-lobes, bluish when ripe. (A variety with white fruit recorded from Kamaon and Lahoul.)

Himalaya not uncommon, between 6000 and 11,000, at times 12,000 ft., from Indus to Sikkim. Fl. June, July. Attains 20 ft., in habit most like the mountain-ash.

P. Aucuparia, Gærtn., the Mountain-ash of Europe and North Asia, with 6-8 pair of leaflets, and scarlet fruit; and *P. Sorbus*, Gærtn., the Service-tree, of South Europe and Western Asia, with glabrous, glutinous buds, and larger pyriform fruit,—are nearly related to this species. *P. foliolosa*, Wall. Pl. As. rar. t. 189, also belongs to the same sub-genus *Sorbus;* it is a shrub with elongated almost twining branches, branchlets and petioles woolly, leaflets entire, only serrated at the apex, and small red fruit. Nepal, Sikkim, Bhutan, 8000-9000 ft. elevation. Fl. May.

6. **CRATÆGUS**, Linn.

Shrubs or small trees, often spiny, with simple, lobed or pinnatifid leaves and deciduous stipules. Flowers white or red, in terminal corymbose cymes, with caducous bracts. Calyx-tube urceolate or campanulate, mouth contracted; lobes 5. Petals 5, inserted at the mouth of the calyx. Stamens many. Carpels 1-5, adnate below to the calyx-tube; styles 1-5, stigma truncate, ovules 2 in each cell. Fruit ovoid or globose, with a bony 1-5-celled stone, or with 5 bony 1- rarely 2-seeded stones.

Leaves deeply pinnatifid . . . . . 1. *C. Oxyacantha.*
Leaves oblong, crenate . . . . . 2. *C. Pyracantha.*

1. **C. Oxyacantha,*** Linn.; Hook. Stud. Fl. 127. *Hawthorn, whitethorn.*—Vern. *Ring, ringo, ramnia, pĩngyat, phindāk, pãtākhan*, Pb.; *Ban-sanjli, sūr sĩnjli*, Jhelam.

A small tree, branchlets spinescent, leaves pinnatifid, segments 2-3 pair, oblong, lobed or dentate, petiole half the length of leaf or less. Stipules large, leafy, falcate or semicordate. Cymes corymbose, many-flowered. Flowers white, carpels 1-2. Pedicels, calyx-tube, and segments, as well as the young fruit, with long thin, soft white hairs. Fruit ovoid or subglobose, glabrous, red, rarely yellow when ripe, with a hard bony 1-2-celled nut.

North-West Himalaya from Indus to Ravi, between 5500 and 9300 ft.; also in Afghanistan, Western Asia, Siberia, and Europe. Cultivated in Afghanistan (Baber's tomb, Kabul; Mahomed's tomb, Ghazni), and near villages in the North-West Himalaya. Fl. June, July; fr. Sept.-Oct. Attains 25-30 ft., with a rounded moderate-sized head. Trunk short, erect, 3-4 ft. girth, dark ash-coloured, rough, wood close-grained. Cultivated on account of its flowers and the edible fruit, which is much better than that of the European hawthorn.

By many botanists the European hawthorn is commonly divided into 2 species (sub-sp. Hooker l. c.) 1. *C. monogyna*, Jacq., with 1 carpel and style, 1 nut, lan-

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* I write *Oxyacantha* and *Pyracantha*, because Linnæus (sp. plant 683, 685) treated these words as substantives.

ceolate calyx-segments, peduncles and calyx-tube pubescent, and deeply lobed or pinnatifid leaves; and 2. *C. Oxyacantha*, Jacq., with 2-3 carpels and styles, 2-3 nuts, calyx-segments triangular, peduncles and calyx-tube glabrous, leaves dentate, with 3 shallow lobes at the top, flowering a fortnight earlier. The Indian specimens approach more to *C. monogyna*, and are referred to it by Boissier l. c. 664. In England there are intermediate forms between the 2 sub-species, though in nursery-grounds the seed of *C. monogyna* is not known to produce plants of the other form (Syme Engl. Bot. iii. 238).

2. **C. Pyracantha**, Persoon.—Syn. *C. crenulata*, Roxb. Fl. Ind. ii. 509; Bot. Reg. 30 t. 52. *Cotoneaster Pyracantha* and *C. crenulāta*, Koch. l. c. 175.—Vern. *Gingāru, giānru*, N.W.P.

A large shrub, or small, much-branched, stiff-branched tree, with spinescent branchlets, glabrous, the youngest branchlets sometimes pubescent. Leaves glabrous, shining, coriaceous, linear-oblong, 1-2 in. long, narrowed into a short marginate petiole, crenate, generally approximate on short lateral branchlets. Stipules deciduous. Flowers white, numerous, smaller than those of *C. Oxyacantha*, in short compound cymes. Carpels 5. Fruit nearly globose, less than ¼ in. diam., orange or vermilion.

Himalaya 5000-7000 ft., from Sutlej to Bhutan. In Kamaon as low down as 2500 ft. Caucasus, Western Asia, and South Europe. Evergreen; fl. April-May; fruit ripens July, Aug. Hardy in England. The western form, *C. Pyracantha*, has scarlet fruit, but there seems to be no other difference sufficiently important to maintain the two as separate species.

Photinia dubia, Lindl. Trans. Linn. Soc. xiii. t. 10, is an evergreen shrub or tree, with coriaceous, crenate, prominently penniveined leaves, and white flowers in terminal panicles. The fruit is an ovoid berry, crowned with the persistent calyx, 1-5-celled, endocarp and dissepiments thin. East Bengal and Burma, has not been found in the N.W. Himalaya. What Madden mentions under this name is *Stranvæsia glaucescens*, Lindl.

7. COTONEASTER, Medicus.

Shrubs or small trees, with alternate, coriaceous, generally entire, often downy leaves and deciduous stipules. Flowers small, white or pink, solitary or in few- or many-flowered axillary or terminal corymbose cymes. Calyx-segments 5, short, persistent. Petals 5. Stamens many, inserted at the mouth of calyx. Carpels 2-5, adnate wholly, or by their backs only to the calyx-tube; styles 2-5, free; stigma truncate; ovules 2 in each cell, erect. Fruit small, with 2-5 bony 1-seeded stones.

Leaves deciduous, soft-pubescent.	
Leaves oblong or ovate; flowers numerous in spreading compound pedunculate cymes	1. *C. bacillaris.*
Leaves ovate-lanceolate; flowers 5-10, in short compact cymes	2. *C. acuminata.*
Leaves more or less persistent, obovate or rotundate, with white woolly tomentum beneath; flowers in short few-flowered cymes	3. *C. nummularia.*
Leaves evergreen, flowers solitary	4. *C. microphylla.*

1. **C. bacillaris**, Wall.—Syn. *C. obtusa*, Wall., and *C. affinis*, Lindl. Vern. *Rī, riu, lin, lūn, rāu, rāuns res, rish*, Pb. Him.; *Ruinsh*, Jaonsar Bawur.

A large deciduous shrub or small tree, with ovate or obovate-oblong leaves, 1-3 in. long, entire, soft-pubescent or tomentose beneath; stipules subulate, early caducous. Flowers white, ⅓ in. across, in pedunculate, spreading, compound, many-flowered cymes, at the end of short leaf-bearing branchlets. Fruit numerous, sub-globose, dark brown, on slender pedicels, in large spreading bunches.

Waziristan, 4000-8300 ft.; Salt range, 1500-2500 ft.; N.W. Himalaya, from Indus to the Sarda at 5000-10,000 ft. Sikkim, Bhutan. Fl. May, June. Wood white, strong, elastic; used for walking-sticks in the N.W. Himalaya. Hardy in England.

C. frigida, Wall.; Bot. Reg. t. 1229, with oblong-lanceolate leaves and bright scarlet fruit. Nepal, Sikkim. Is nearly allied to this sp., and perhaps not specifically distinct.

2. **C. acuminata**, Lindl. Trans. Linn. Soc. xiii. t. 9, p. 101.—Vern. *Riū, rāuns, ruinsh.*

A deciduous shrub, with fasciculate, ovate-lanceolate, subcoriaceous leaves, entire, 1-2 in. long; extremities and young leaves with soft silky hairs. Stipules subulate, ciliate. Flowers white, ¼ in. across, in compact cymes with 2-10 flowers, at the end of short leaf-bearing branchlets. Calyx turbinate, glabrous or with long white soft hairs; segments short, rounded or acute, often fringed with soft white hairs. Fruit subcylindrical or turbinate, thicker at top, ⅓ in. long (red when ripe, cult. at Kew).

Himalaya, Bias to Sikkim, 4500-10,000 ft. Fl. May-July. Wood white; walking-sticks are made of it on the Deoban range, in Jaonsar Bawur, and exported to the plains. Hardy in England.

3. **C. nummularia**, Fisch. et Meyer; Boissier Fl. Orient. ii. 666.

A shrub or small tree, nearly evergreen, with obovate, rotundate, or broad-elliptic leaves, ½-1 in. long, obtuse, retuse, or mucronate, densely clothed beneath with white woolly tomentum. Flowers white or pink, ¼ in. across, in short, nearly sessile, few-flowered cymes at the end of short leaf-bearing branchlets. Calyx and pedicels densely white tomentose. Fruit black.

Afghanistan, Beluchistan, N.W. Himalaya from the Indus to Bhutan, 6000-11,000 ft. Also on the Caucasus, in the Crimea, Armenia, and Syria. Fl. April, May. Hardy in England.

A sp. of *Cotoneaster*, with glabrous calyx, larger flowers in pedunculate cymes, pubescent pedicels, is found in Hazara, Kashmir, and the arid tracts of the inner Himalaya (Piti, Lahoul), and is probably the same as the common European species, *C. vulgaris*, Lindl., Hook. Stud. Fl. 127, which is also known from Siberia and Tibet. The fruit of the European shrub is red, rarely black.

4. **C. microphylla**, Wall.; Bot. Reg. t. 1114.—Vern. *Khāriz, lūni*, Kashmir; *Garri*, Kamaon.

An erect or prostrate evergreen shrub, with small, coriaceous, glossy dark-green, obovate or cuneate-oblong leaves, solitary, large, snow-white flowers, nearly ½ in. across, and scarlet fruit.

Common in the Himalaya from Kashmir to Bhutan, 5000-11,000 ft. Fl. May, June. Used in Kashmir for making baskets. The ripe fruit is sweet. (J. L. S.)

This small showy shrub is hardy in England, and is cultivated in a great variety of forms, some of which have been described and figured as distinct species (*C. thymæfolia*, *congesta*, Saunders Refugium Botanicum, t. 50, 51).

C. buxifolia, Wall.; Wight Ic. t. 992, with 3-flowered peduncles, and ovate leaves, from Kamaon, and the Nilgiris and Pulneys, is closely allied to *C. microphylla*. On the Nilgiris and Pulneys this is a very rigid ramous shrub or small tree; the wood is dense and elastic, and clubs are made of it (Bedd. Fl. Sylv. Manual, p. 98).

8. **STRANVÆSIA**, Lindl.

A tree, with alternate, simple, serrulate, coriaceous evergreen leaves and flowers in large corymbose cymes. Calyx-tube campanulate, base semiadnate to the ovary, with 5 short, erect, persistent segments. Petals 5, sessile, pilose at base. Stamens 20; filaments subulate, inserted in the mouth of calyx. Ovary villose, half free, 5-celled, 2 ovules in each cell; styles 5, connate half-way up, stigma reniform. Fruit a fleshy drupe, including a 5-celled, 5-valved capsule; dehiscing loculicidally, the crustaceous valves separating from each other and from the axis, the dissepiments remaining attached to the inner face of the valves.

1. **S. glaucescens**, Lindl. Bot. Reg. t. 1956.—Syn. *Cratægus glauca*, Wall. Vern. *Garmehal*, *sūnd*, Kamaon.

A small evergreen tree, with lanceolate leaves 4-6 in. long, glabrous above, pale beneath, and pubescent along the middle nerve. Flowers white, ½ in. across. Calyx white-tomentose.

Himalaya, outer ranges, Garhwal, Kamaon (woods and ravines, associated with *Quercus*, *Andromeda*, *Myrica*, and *Symplocos*), Nepal, generally between 3000 and 4000 ft., ascends to 8000 ft. Kasia hills. Fl. April, June. Fr. Sept., Oct. Very tender in England. 20 ft. high, trunk short, crown close, rounded, dark green. Wood dull reddish-brown, fine-grained, hard.

ORDER XXXIII. **SAXIFRAGEÆ.**

Trees, shrubs, or herbs; flowers regular, generally bisexual. Calyx free, or adnate to ovary, 5-lobed, rarely 4-12-lobed, valvate or imbricate in bud. Petals 5, rarely 4 or none, imbricate or valvate in bud. Stamens as many as petals, or double their number, free; anthers dorsifixed, connective frequently glandular at the back. Disc tumid, annular or glandular. Carpels 2 or more, usually connate into a 2- rarely 1-celled ovary; styles as many as cells, free or united; stigmas capitellate; ovules many, placentæ attached to the inner angle; parietal in the 1-celled ovaries. Fruit a 1-3-celled berry or capsule, or of 2 or more many-seeded follicles. Seeds small; embryo minute, in a copious, fleshy or horny albumen.—Gen. Pl. i. 629; Royle Ill. 215 (*Philadelpheæ*), 225 (*Grossularieæ*, *Saxifrageæ*); Wight Ill. ii. 50.

Leaves opposite.	
Stamens 8-10; flowers in terminal corymbs; outer flowers large, sterile	**1. HYDRANGEA.**
Stamens 10; capsule globose, separating into 3-5 distinct cocci	**2. DEUTZIA.**
Stamens numerous; capsule turbinate, dehiscing loculicidally	**3. PHILADELPHUS.**

Leaves alternate.
 Flowers numerous, in long racemes; fruit a 2-celled capsule, free . . . . 4. ITEA.
 Flowers axillary, or in short racemes; fruit a berry, inferior, crowned by the remains of calyx . . . . . . 5. RIBES.

1. HYDRANGEA, Linn.

Erect or climbing shrubs or trees. Leaves opposite, petiolate, exstipulate. Flowers in terminal corymbs with deciduous bracts, the outer flowers often sterile and larger than the fertile inner flowers. Calyx-tube adnate to the ovary, turbinate or hemispherical; limb truncate or 4-5-dentate. Petals 4-5, valvate. Sterile flowers apetalous, but calyx-limb with 4-5 large petaloid veined segments. Stamens 8-10, inserted at the base of an epigynous disc, filaments filiform, anthers short. Ovary inferior, more or less incompletely 2-4-celled; styles 2-4, free or connate at the base; ovules very numerous. Fruit a membranous capsule, crowned by the calyx-limb, and the persistent styles, 2-4-celled, dehiscent at the top between the styles, many-seeded. Seeds minute, with a membranous testa; embryo in fleshy albumen.

1. **H. altissima,** Wall. Tent. Fl. Nep. t. 50.

A large climbing shrub, glabrous, with loose, grey or brown, membranous, shining bark, peeling off in long rolls like that of the birch. Leaves ovate, acuminate, dentate, 4-6 in. long; petiole 1-2 in.; main lateral nerves 6-8 on either side of midrib. Flowers whitish, calyx-segments of sterile flowers $\frac{1}{4}$-$\frac{1}{2}$ in. long, obovate.

Himalaya, 5000-10,000 ft. in shady forests from Sutlej (Nagkanda, Serahn) to Bhutan. Fl. June, July. Very tender in England. Bark used as a substitute for paper (T. Thomson, Him. Journ. 47).

Two other species are found in Kamaon: *H. aspera,* Don., with oblong-lanceolate leaves, sharp serrate, grey tomentose beneath, styles free from the base; and *H. vestita,* Wall., pubescent, with broader leaves, and styles connate at the base.

H. Hortensia, DC., the common Hydrangea, or *Chinese Guelder Rose,* from China and Japan, is cultivated as an ornamental shrub in Europe and India on account of the splendid heads of sterile flowers, which are green at first, then rose-coloured or blue.

2. DEUTZIA, Thunb.

Shrubs, pubescent or scabrous, hairs generally stellate. Leaves and branches opposite. Leaves serrate, exstipulate. Flowers white, corymbose or axillary. Calyx-tube campanulate, adnate to the ovary; limb 5-toothed. Petals 5, induplicate-valvate or imbricate in bud. Stamens 10, inserted under the edge of the epigynous disc, the alternate stamens longer; filaments flat, often winged, terminating in two teeth at the top; anthers didymous, nearly globose. Ovary inferior, 3-5-celled; styles 3-5; ovules numerous, imbricate on fleshy placentæ. Capsule globose, 3-5-celled, separating septicidally into 3-5 distinct cocci, or dehiscing at the apex between the styles. Seeds numerous; testa membranous; albumen fleshy.

Rough, with grey stellate pubescence; petals oblong, pubescent 1. *D. staminea.*
Smooth, with soft scattered stellate hairs; petals obovate, smooth 2. *D. corymbosa.*

1. **D. staminea**, Brown; Wall. Pl. As. rar. t. 191; Bot. Reg. xxxiii. t. 13.—Vern. *Muneti*, Kamaon.

A shrub, branchlets and inflorescence scabrous with grey stellate pubescence. Leaves lanceolate or ovate-lanceolate, 1-2½ in. long, on short petioles, rough on both sides with stellate pubescence, grey beneath. Flowers white, fragrant, on short trichotomous panicles, with linear bracts, at the ends of branchlets. Calyx-teeth triangular acute, somewhat shorter (when in flower) than the cup-shaped tube. Petals oblong, pubescent outside.

Himalaya, 5000-8000 ft., from Kashmir to Bhutan. Fl. May, June. Hardy in England. A variety with larger flowers is *D. Brunoniana*, Wall.

2. **D. corymbosa**, Brown; Royle Ill. t. 46, f. 2; Bot. Reg. xxvi. t. 5.

A shrub, not scabrous; branchlets and leaves with scattered, soft, stellate hairs or scales; bark peeling off in long shining rolls. Leaves ovate-lanceolate, long-acuminate, 2-5 in. long, on short petioles. Flowers white, in broad, trichotomous, corymbose panicles, at the ends of branchlets; bracts small, deciduous. Calyx-teeth ovate, obtuse, shorter when in flower than the hemispherical tube. Petals broad-obovate or rounded, glabrous.

Himalaya, 6000-10,000 ft., from Sutlej to Bhutan. Fl. May, June. Hardy in England.

3. PHILADELPHUS, Linn.

Shrubs, often with stellate hairs. Leaves and branches opposite; no stipules. Flowers white or straw-coloured, axillary or corymbose. Calyx-tube turbinate, adnate to the ovary, with 4, rarely 5 lobes, valvate in bud. Petals 4, rarely 5, convolute in bud. Stamens 20-40, inserted under the edge of the epigynous disc; filaments subulate; anthers globose. Ovary 3-5-celled; styles 3-5; ovules numerous, imbricate. Capsule turbinate, 3-5-celled, dehiscing loculicidally. Seeds numerous, testa membranous, reticulate; albumen fleshy.

1. **P. coronarius**, Linn.—Syn. *P. tomentosus*, Wall.; Royle Ill. t. 46 f. 1.

A shrub, branchlets glabrous. Leaves ovate, sometimes elliptic, acuminate, dentate with distant teeth, clothed beneath with long soft white hairs, 2-3 in. long, on petioles ¼-⅓ in. long; three pairs of main lateral nerves, two from the base or from near the base, arcuate, the innermost pair nearly meeting at the apex of the leaf, a third pair generally halfway up the midrib. Flowers axillary, in short racemes at the ends of the branches, strongly scented. Calyx-lobes pubescent inside, ovate, nearly as long as calyx-tube. Style deeply 4- or 5-cleft, as long as stamens or shorter.

North-West Himalaya, Kishtwar to Kamaon 6000-10,000 ft., Sikkim. Fl. May-July. Also in Japan, China, Mantshuria, the Caucasus, and (indigenous or naturalised) in Central Europe. Hardy in England. I cannot find any specific difference between the European and Himalayan shrub. The former is less hairy, and has more elliptic leaves.

4. ITEA, Linn.

Trees and shrubs, with alternate, petiolate, exstipulate leaves. Flowers small, white, in long, terminal, and axillary simple racemes. Calyx-tube adnate at the base to ovary, with 5 ovate or subulate persistent lobes. Petals 5, perigynous, linear. Stamens 5, inserted under the edge of a perigynous disc; anthers short, oblong. Ovary oblong, free or half free, 2-celled; style simple, erect, persistent, with 2 furrows. Capsule free, septicidally 2-valved, each valve terminated by half the style, the stigma cohering. Seeds numerous or few. Embryo cylindrical, in the axis of a scanty fleshy albumen.

1. **I. nutans**, Royle.—Vern. *Lelar*, Kaghan; *Garkath*, Kamaon.

A shrub, leaves ovate-oblong or elliptic-oblong, acuminate, sharply serrate, 4-6 in. long, subcoriaceous, glabrous and shining above, pubescent or glabrous beneath; main lateral nerves 5-7 pair, anastomosing by slender, closely parallel, transverse, and by distinct intramarginal veins. Flowers in fascicles of 3-5, on pedicels as long as calyx, in slender drooping racemes 4-8 in. long. Calyx and pedicels pubescent or glabrous. Capsules reflexed.

North-West Himalaya 3000-6000 ft., from Hazara (rare) to Kamaon. Fl. Apr.-July.

5. RIBES, Linn.

Shrubs, often armed with prickles. Leaves alternate, entire or lobed, plaited or convolute in bud. Stipules none or adnate to petiole. Flowers white red yellow or green, solitary or racemose, often unisexual; pedicels bracteate. Calyx adnate to ovary, limb tubular or campanulate, 4-5-fid, imbricate or subvalvate in bud. Petals small, 4-5. Stamens as many as, and inserted with petals in the throat of the calyx. Ovary inferior, 1-celled; styles 2; ovules few or many, on 2 slender parietal placentæ. Berry ovoid or globose, 1-celled, with few or many seeds. Seeds horizontal; testa with a gelatinous coat; albumen adhering to the testa; embryo minute.

- Armed; peduncles 1-2 flowered . . . . . . 1. *R. Grossularia.*
- Unarmed; flowers racemose unisexual; racemes erect; calyx-limb short, flat.
  - Pubescent and viscid with stipitate glands; leaves nearly orbicular with obtuse lobes . . . . . 2. *R. orientale.*
  - Nearly glabrous; leaves with large acute or acuminate lobes . 3. *R. glaciale.*
- Unarmed; flowers racemose bisexual, racemes drooping; calyx-limb campanulate.
  - Leaves glandular, dotted beneath; bracts minute . . 4. *R. nigrum.*
  - Leaves eglandular; bracts ovate . . . . . 5. *R. rubrum.*

1. **R. Grossularia**, Linn.; Wall. in Fl. Ind., ed. Carey, ii. 515; Hook. Stud. Fl. 134.—Syn. *R. Himalense*, Royle. *R. alpestre*, Wall.; Jacq. Voy. Bot. t. 75. *Gooseberry.* (*Krusbär*, Swed.; *Groseille*, Fr.; *Krushownik*, Russ.; *Krausbeere*, *Graselbeere*, local German names, seem all to have the same origin, and *Grossularia* is derived from them.) Vern. *Pīlsa*, *pīlīkcha*, *kānsi*, *teila*, *amlānch*, Upper Chenab and Lahoul.

A small pubescent shrub, armed with 1-3 spines under the leaf-buds, and often with smaller scattered prickles. Leaves fasciculate on short lateral branchlets, nearly orbicular, 3-5-lobed, 1 in. diam.; lobes irregularly crenate. Flowers solitary or twin, greenish, drooping, on short, pubescent, 1-3-bracteate peduncles. Berries glandular-hairy.

Southern flank of Safedkoh 8000-12,000 ft. Arid tracts of the inner Himalaya, from the Indus to Kamaon, between 8000 and 11,500 ft. Kaghan, Lahoul, Kunawar, Niti, Europe (in Norway to near the 63d degree N. lat.), North Africa, Armenia, Caucasus. Fl. spring; fruit ripe Sept.-Oct., small and sour. Linnæus established two species: *R. Grossularia*, with glandular hairy fruit, *R. Uva crispa*, with the ripe fruit glabrous. Both are cultivated in numerous varieties throughout Europe; they are, however, now commonly united into one species.

2. **R. orientale**, Poiret; Boissier Fl. Orient. ii. 817.—Syn. *R. leptostachyum*, D^{ne}. in Jacq. Voy. Bot. t. 76. *R. villosum*, Wall. in Fl. Ind., ed. Carey, ii. 514. *R. glandulosum*, Thoms. West Him. 104. Vern. *Gwāldakh*, *kaghāk*, Kaghan; *Nangke*, *nyāi*, *phulānch* (the fruit *nyángha*), Chenab; *Askūta*, *askūtar*, Ladak; *Yange*, Piti.

A small shrub, unarmed, pubescent with short hairs, and viscid all over with numerous, yellow or brown stipitate glands. Leaves generally fasciculate; branchlets marked with the scars of bud-scales and leaves. Leaves nearly orbicular, with cordate or rounded base, 3- rarely 5-lobed, crenate-dentate, greyish brown beneath; basal nerves 3 or 5, with few lateral nerves. Flowers unisexual, dioicous, in erect racemes, with linear or oblong, concave, ciliate, deciduous bracts, somewhat longer than pedicels. Male racemes with many, female with few flowers. Calyx flat, cup-shaped; segments ovate, obtuse, much longer than the small obovate petals. Filaments short, not exceeding anthers. Berry red or yellow when ripe, with scattered glandular hairs, ¼ in. long or less, with about 10 seeds.

Safedkoh 8000-10,000 ft. Arid tracts of inner Himalaya, between 6500 (on the Indus, T. Thomson) and 14,000 ft., from the Indus to Nepal. Tibet. Afghanistan (Griff.) Persia. Kurdistan, Caucasus, Armenia, Syria (Hermon, Lebanon). I follow Karl Koch, Dendrol. 656, and Boissier l. c., in uniting under one species the West Asiatic and Himalayan plant, as I find no specific difference. Fl. April-June; fruit ripe Oct., mawkish sweet.

3. **R. glaciale**, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 513.—Syn. *R. acuminatum*, Wall.

An erect, unarmed shrub, glabrous or slightly pubescent; branches with brown, shining, perfectly smooth cuticle, peeling off in long strips or rolls. Leaves 1-3 in. long, 3- sometimes 5-lobed, lobes acute or acuminate, more or less deeply cut, the subdivisions serrate, basal nerves 3-5, the midrib with 2-4 pairs of main lateral nerves; glabrous or pubescent beneath along the nerves, occasionally with scattered sessile or stipitate glands. Flowers green (Wall.), fuscous (H. & Th.), in pubescent and glandular racemes, 2-3 in. long, erect when in flower, drooping when in fruit; bracts linear-oblong, longer than pedicels, nearly as long as flowers. Berry round, smooth, red, (black?), as large as a common red currant, sour and astringent.

Himalaya at high elevations, 7000-11,000 ft., from Kashmir to Bhutan. Fl. May. Hardy in England.

4. **R. nigrum**, Linn.; Hook. Stud. Fl. 134; Hooker & Thomson, Præcursores ad Fl. Ind. in Journ. Linn. Soc. ii. 88. *Black Currant.*

An erect unarmed shrub; calyx and underside of leaves with round, sessile, yellow glands; petioles and racemes pubescent. Leaves somewhat longer than broad, with cordate base, 3- rarely 5-lobed; lobes triangular, acute, serrate, 2-3 in. long; basal nerves 3, each with 2-4 pair of main lateral nerves. Petioles as long as leaf, with a broad winged base. Racemes slender, few-flowered, drooping; bracts minute, much shorter than pedicel. Berries $\frac{1}{3}$ in. diam., globose, black (in gardens in Europe also white and purple), with a strong aromatic smell and taste.

Kashmir (5000-11,000 ft.), Kunawar (7000-12,000 ft.), Garhwal and Kamaon, vern. *pāpar* (6000-10,000 ft.), J. L. S. Europe, Siberia, Dahuria. Fl. July; fruit ripe Aug.-Sept.

5. **R. rubrum**, Linn.; Hook. Stud. Fl. 134.—Syn. *R. Himalense*, Dne. in Jacq. Voy. Bot. t. 77. Vern. *Gwāldākh*, Khāgān; *Rōde*, *murādh*, *nābar*, *nābre*, Chenab.

An erect unarmed shrub, without glands. Petioles and racemes pubescent. Leaves glabrous or pubescent, often with long scattered hairs, as broad as long, with cordate base, 3- rarely 5-lobed; lobes ovate-triangular, crenate, basal nerves 3 or 5, the 3 inner penniveined, with 3-5 pair of main lateral nerves. Petioles as long as or longer than leaves, with a broad, membranous, often ciliated base. Racemes many-flowered, drooping; bracts ovate, shorter than or as long as pedicel. Berries $\frac{1}{4}$ in. diam., globose, red, acid (sweet insipid, Jacquemont).

Himalaya between 5000 and 12,000 ft., both in the outer moister region and the inner arid tracts. The red currant is indigenous in Europe, in Siberia, as far as Kamtchatka, and in North America. Red and white varieties are cultivated in gardens in Europe. In Lahoul the berries (*niangha*), are yellow when unripe, black but with the taste of red currants when ripe (Jæschke). The Lahoul specimens have large flowers, with a deep campanulate calyx, the lobes of which are ciliate. I follow Hooker and Thomson, l. c. 89, in referring *R. Himalense*, Dne., to *R. rubrum*, L.; but the matter seems to demand farther inquiry.

ORDER XXXIV. HAMAMELIDEÆ.

Shrubs and trees, with petiolate leaves, and persistent or deciduous stipules. Flowers unisexual or bisexual. Calyx-tube more or less adnate to ovary, limb truncate or lobed. Petals 4-∞, occasionally wanting. Stamens 4-∞, definite or indefinite, perigynous. Ovary consisting of 2 carpels, generally free and rostrate at the top, 2-celled; styles 2, subulate. Fruit a 2-valved capsule, the carpels separating at the top, rostrate with persistent styles. Seeds with a straight embryo in a fleshy albumen. —Gen. Pl. i. 664; Royle Ill. 234.

1. PARROTIA, C. A. Meyer.

Trees and shrubs, with large, deciduous stipules, deciduous crenate leaves and capitate flowers, the flower-heads enclosed in large membranous bracts. Calyx campanulate, adhering to the base of ovary; petals none. Stamens 5-15, perigynous; filaments long, filiform; anthers basifixed, oblong, dehiscing longitudinally. Ovary 2-celled; styles 2 (rarely 3); one ovule in each cell.

1. **P. Jacquemontiana**, Decaisne—**Tab. XXVIII.**—Jacq. Voy. Bot. t. 82.—Syn. *Fothergilla involucrata*, Falconer. Vern. *Pusser*, *peshora*, *pahu*, *po*, *kīllar*, *kīrru*.

A large deciduous, gregarious shrub or small tree, with stellate pubescence on young branches, stipules, calyx, and the underside of young leaves. Leaves orbicular or obovate, obtuse, penniveined, the lowest pair of nerves from the base, margin deep-crenate. Stipules broadly oblong, as long as petioles or longer. Flower-heads ovoid, ½ in. long, with about 20 sessile flowers, on short thick stalks, generally at the end of short, leaf-bearing branchlets, each head enclosed in 4 large rotundate bracts, membranous, white, often emarginate. Flowers bisexual; calyx campanulate; limb thick, woolly, truncate or with a few linear lobes. Stamens generally 15, inserted inside the limb of calyx; anthers oblong without appendage, the cells dehiscing laterally by 2 narrow longitudinal valves, opening like a pair of folding-doors. Capsule woolly, with stellate tomentum, girt by the adhering calyx-tube, 2-celled, the cells separating when ripe, each cell with 1 seed in a hard, horny endocarp, which opens at the top in 2 rostrate valves. Embryo oblique in copious albumen.

North-West Himalaya in many places, from the Indus to the Ravi, at elevations between 2800 and 8500 ft. Rare trans-Indus. Generally found on low slopes, growing gregariously in extensive thickets, often covering several acres, to the exclusion of other shrubs, and with little or no grass underneath. The stems are grouped in close clusters of 5-6 or more together, 15-20 ft. high, and about 15 in. girth, with a few divaricate branches at the top. Rarely solitary, with a more tree-like habit. Fl. March-May; fr. July-Sept. The foliage turns yellow before being shed.

Bark thin, firm, dark brown, occasionally light silvery grey, with many specks, and transverse, blotchy, darker rings, not much marked, except by small circular, elevated, whitish spots. Sapwood whitish, heartwood brown, close, compact, fine- and even-grained, strong, 12-16 rings per inch of radius. Highly esteemed for walking-sticks, charpoys, tent-pegs, and rice-pestles, also used for bows (goleil) for throwing pellets (gol) of baked earth.

This tree is valuable on account of the toughness and pliability of its twigs, which are used extensively for binding loads and basket-work. They are preferred to all other material for making the twig-bridges over the great rivers of the Panjab Himalaya. These bridges are often 300 ft. long, and consist of one large rope to walk on, and two smaller side ropes, one for each hand, with much smaller ropes connecting the hand-ropes with the foot-rope. In Western Kashmir, near Mozuffurabad, these ropes are made of hides, but ordinarily they are twisted of twigs of *Parrotia*, when it can be got, mixed with *Cotoneaster*, *Olea*, and *Indigofera*, and where these plants are not attainable, they are made of the *Birch* and *Willow*. The Parrotia is cut for this purpose at all seasons of the year. With frequent piecemeal repair such bridges do not generally last more than three years.

P. persica, C. A. Meyer; Led. Fl. Ross. ii. 376, Boissier Fl. Orient. ii. 818, which grows in the low forests on the south and south-west coast of the Caspian Sea (hardy in England), differs by long, apiculate anthers, dehiscing longitudinally in the ordinary manner.—Oliver Trans. Linn. Soc. xxiii. 459.

ORDER XXXV. RHIZOPHOREÆ.

Trees and shrubs, generally glabrous, with opposite, petiolate, coriaceous, entire leaves. Stipules interpetiolar, early caducous. Flowers generally bisexual, regular. Calyx more or less adherent to the ovary, or free, limb 4-14-toothed or -lobed; lobes valvate, usually coriaceous and persistent. Petals as many as calyx-lobes. Stamens 2-4 times the number of petals; filaments free; anthers 2-celled, dehiscing longitudinally, or with numerous cells. Ovary 2-5-celled, or dissepiments partially suppressed; ovules mostly geminate, collateral, pendulous; style generally 1; stigma simple or lobed. Fruit coriaceous, 1-celled, 1-seeded, indehiscent, or 3-4-celled, and septicidally dehiscent.—Gen. Pl. i. 677; Royle Ill. 210; Wight Ill. i. 207.

The seed germinates on the tree, with a long exserted radicle (*Mangrove* trees).
  Ovary adnate at the base only, protruding beyond the calyx-tube.
    Calyx 4-merous; petals entire; anthers multilocellate, subsessile, ovary 2-celled . . . . . . 1. RHIZOPHORA.
    Calyx 5-6-merous; petals truncate, or bifid, with apical setæ; anthers 2-celled; filaments filiform . . . . 2. CERIOPS.
  Ovary entirely adnate to and included in the calyx-tube, calyx 8-14-merous; petals bifid, with apical setæ; anthers 2-celled; filaments filiform . . . . . . 3. BRUGUIERA.
The seed does not germinate on the tree; calyx-segments 5-8; petals 5-8; stamens 10-16 . . . . . . 4. CARALLIA.

1. RHIZOPHORA, Linn.

Trees with stout branchlets, marked with annular scars of leaves and stipules, wholly glabrous. Stipules elongate. Cymes axillary, pedunculate, few- or many-flowered. Flowers coriaceous. Calyx-tube short, supported by confluent bracts; limb 4-lobed; lobes triangular or oblong. Petals 4, entire, edges generally with long woolly hairs. Stamens 8-12, perigynous; anthers sessile or nearly so, erect, linear-oblong, triangular in section, the 2 inner faces multilocellate, pollen liberated by the separation from the inner faces of a common membrane. Ovary half-inferior, 2-celled; ovules geminate, pendulous; style 2- dentate at the top. Fruit coriaceous, long-exserted, ovoid or conic, 1-celled, 1-seeded. Seed without albumen; cotyledons conferruminate. Germination takes place in the fruit on the tree, the radicle protrudes soon after flowering as a long cylindrical body, thicker near the end, attains a length of 12 in. or more, and at length roots in the mud when the fruit falls.

1. **R. mucronata**, Lam.; Wight Ic. t. 238.—Syn. *R. Mangle*, Roxb.; Fl. Ind. ii. 459. *R. Candelaria*, W. & A. Prodr. 310. Vern. *Kamo*, Sindh; *Bhora*, Beng.

A moderate-sized tree, with elliptical leaves, terminating in a distinct mucro or narrow apiculus, broadly cuneate, or slightly rounded at base; blade 3-5 in. long, 2-3 in. broad; midrib very prominent beneath, attenuate upwards. Peduncle axillary, compressed, often recurved, longer than petiole, bearing lax few-flowered dichotomous cymes. Flowers 8-androus, sweet-scented; calyx-segments triangular; petals white, edges woolly. Fruit ovoid, furrowed, supported at the base by the calyx. The radicle of the seed germinating on the tree often 2½ ft. long.

Sindh, tidal creeks of the estuary of the Indus. Coasts and back-waters of the peninsula, Bengal and Burma. A widely-spread species on the coasts of Africa, and over the Indian Archipelago to Australia. 25 ft. high, with a small crown. Wood red, hard, and durable; the bark is used for tanning, the fruit is said to be eatable.

R. conjugata, Linn., a small tree, nearly related to this, and frequently associated with it, has narrow leaves, short 2-3-flowered cymes nearly sessile below the leaves, 12 stamens, and the radicle attaining 12-18 inches.

2. CERIOPS, Arnott.

Trees or large shrubs, wholly glabrous. Flowers coriaceous. Calyx-tube short, supported by confluent bracts; limb 5-6-partite; segments oblong-lanceolate. Petals 5-6, truncate, or emarginate. Stamens 10-12, inserted between the divisions of a lobed, annular disc; filaments slender, filiform; anthers small, ovate-oblong, 2-celled, dehiscing longitudinally. Ovary half-inferior, 3-celled; ovules 2 in each cell; style undivided. Fruit and germination as in *Rhizophora.*

1. **C. Candolliana**, Arnott; Wight Ic. t. 240.—Vern. *Kirrari, chauri*, Sindh.

A tall shrub or small tree, with obovate leaves 2-3 in. long, 1-2 in. broad, base cuneate, apex broad, rounded; midrib prominent beneath. Peduncles short, bracteolate, and shortly 2-3-forked at the top. Flowers subsessile, subcapitate. Petals 5, oblong, truncate, with 3 clavate setæ, base abruptly narrowed, margins slightly cohering below the middle. Stamens 10, alternately shorter.

Sindh, mud forests at mouth of Indus and salt-water creeks. Coast of peninsula, Indian Archipelago, extends to Australia, and is found on the east coast of Africa. Wood hard, durable, used for the knees of boats, and for other purposes in Sindh. Bark employed as litter for cattle.

Kandelia Rheedii, W. & A. Prodr. 311, Wight Ill. t. 89, is a small tree, common on the western coast, also in Bengal and Burma, which may possibly be found in Sindh. Leaves oblong, obtuse; peduncles axillary, much longer than petioles, 2-3-chotomous, with 4-9 pentamerous flowers, petals narrow, deciduous, thin, membranous, bifid, edge laciniate, hairy; stamens numerous, and an oblong-conical fruit much longer than the calyx-tube.

3. BRUGUIERA, Lam.

Trees with the habit of *Rhizophora.* Flowers coriaceous, solitary or few together, on short, axillary, recurved peduncles, without bracts. Calyx ebracteolate, turbinate, adnate at the base to the ovary, the upper portion free; segments 10-15, thick, linear. Petals as many, 2-lobed. Stamens twice the number of petals; anthers linear, 2-celled, mucronate, about as long as filaments. Ovary inferior, included in calyx-tube, 2-4-celled, with 2 pendulous ovules in each cell; style filiform, with 2-4 minute stigmatic lobes. Fruit turbinate, crowned by the persistent calyx-lobes. Germination as in *Rhizophora.*

1. **B. gymnorhiza,** Lam.; W. & A. Prodr. 311.—Syn. *B. Rheedii,* Blume; Wight Ic. t. 239 A. *Rhizophora gymnorhiza,* Roxb. Fl. Ind. ii. 460; Griff. Ic. t. 645 iv. Vern. *Kakra, kankra,* Beng.

A large evergreen tree, with oblong-elliptical, short-acuminate leaves 3-6 in. long, 1¼-2¼ in. broad, narrowed into a petiole about 1 in. long. Stipules oblong, 1-2 in. long, very deciduous. Flowers solitary, about 1 in. long. Calyx thick and rigid, lobes usually about 12, the tube about ⅓ the whole length. Petals shorter than calyx, deeply 2-lobed, densely hairy at the base; margins induplicate, more or less hairy all the way up; setæ usually 1 in the notch and 3-4 at the end of each lobe. Anthers embraced in pairs by the induplicate edges of the petals. Fruit at first crowned by the calyx-limb, which often falls off as the radicle protrudes, the latter assuming a narrow spindle-shaped form, with about 6 prominent angles.

Sindh, estuary of the Indus. Coast of Peninsula, Sundarbans. Indian Archipelago. North Australia. Wood yellowish brown, hard and durable. This tree sends down numerous roots from the trunk and branches, which eventually raise the stem, so that it appears divided before it reaches the ground. *Rhizophora mucronata* and other Mangroves do the same. Griffith (on the family of the Rhizophoreæ, Transactions of the Medical and Physical Society of Calcutta, viii. 6) ascribes the lifting up of the stem to the resistance which the roots meet at their extremities. Nearly allied to this, and probably a variety only, is—

B. eriopetala, Wight. Ill. i. p. 210, Ic. t. 239 B—syn. *B. parietosa,* Griff. Ic. t. 641,—with large solitary flowers, calyx-lobes 8-12, margin of petals from base to apex densely hirsute.

Three other Indian species enumerated in Wight's Ill. p. 210, differ from *B. gymnorhiza* by smaller flowers in axillary, pedunculate 2-to many-flowered cymes; they are small glossy trees closely allied to each other, and probably form one species only. 1. *B. caryophylloides,* Blume (*Rhiz. caryophylloides,* Griff. Ic. t. 642). 2. *B. malabarifica,* Arnott. 3. *B. parviora,* Arnott (*Rhizophora parviflora,* Roxb. Fl. Ind. ii. 461).

4. CARALLIA, Roxb.

Trees and shrubs, wholly glabrous, with small flowers in pedunculate, compact trichotomous cymes. Calyx-tube campanulate, produced beyond the ovary, with 5-8 short segments. Petals as many as calyx-segments, unguiculate, orbiculate, serrate or laciniate. Stamens twice the number of petals, inserted on the crenulate edge of the disc, which clothes the calyx-tube. Ovary adnate to calyx, generally 4-celled; ovules 2 in each cell. Embryo terete in a copious albumen.

1. **C. integerrima,** DC.; Bedd. Fl. Sylv. t. 193; Benth. Journ. Linn. Soc. iii. 74.—Vern. *Manioga,* Burm.

A large tree, with entire, elliptic obovate or oblong leaves. Flowers 6-8-merous, nearly sessile in capitate cymes; petals white, orbicular, deeply laciniate, with lanceolate segments.

Common in evergreen forests of South India, Burma, Bengal, and the Eastern Himalaya. On the western coast it extends to the latitude of Bombay, and will probably be found in the range of this Flora either on the Satpura hills or in the Gorakhpur, Oudh, or Kamaon forests. Found also in South China, the Philippine Islands and tropical Australia. Timber reddish brown, rather brittle, but very ornamental, with broad medullary rays, which show on a vertical section like undulating, broad irregular bands, giving the wood a beautiful mottled appearance. Polishes well.

C. lucida, Roxb. Cor. Pl. t. 211; Fl. Ind. ii. 481; Wight Ic. t. 605, is doubtfully referred to *C. lanceæfolia*, Roxb. by Bentham, l. c. 75. In Wall. cat. 4880 *C. lucida* is quoted from Kamaon.

ORDER XXXVI. COMBRETACEÆ.

Trees or shrubs, with simple, petiolate, entire leaves, without stipules. Flowers bracteate, bisexual, rarely polygamous. Calyx-tube adnate to the ovary; limb 4-5 cleft, generally campanulate with valvate segments. Petals none, or 4-5. Stamens as many as calyx-segments, or twice the number, inserted on the limb or inside the calyx. Ovary wholly adnate to calyx-tube, 1-celled; style simple, filiform. Fruit often winged or angled, 1-celled or 1-seeded. Seed pendulous, with a coriaceous or membranous testa, without albumen. Embryo straight, with a small superior radicle, and fleshy, oily, convolute, plicate, or contortuplicate cotyledons. —Gen. Pl. i. 683; Royle Ill. 209; Wight Ill. i. 211.

Flowers in spikes or racemes.
  Climbing shrubs or undershrubs, with opposite leaves . 1. COMBRETUM.
  Trees or shrubs wholly glabrous, with alternate thick fleshy leaves . . . . 2. LUMNITZERA.
  Large trees, with alternate or subopposite leaves; fruit large, a fleshy drupe, or dry, with 3-7 wings . . . 3. TERMINALIA.
Flowers in globose heads; fruit small, flat, imbricated . . 4. ANOGEISSUS.

Calycopteris floribunda, Lam. (*Getonia floribunda*, Roxb. Cor. Pl. t. 87; Fl. Ind. ii. 428), is a large climbing shrub; branchlets, underside of leaves, inflorescence, and calyx rusty-pubescent; leaves opposite, ovate-lanceolate; flowers greenish, in large rounded, terminal panicles. Fruit villous, ovoid, 1-seeded, crowned with the persistent calyx, with 5 enlarged, linear-lanceolate, membranous lobes, ½-1 in. long.—Burma, Bengal, South India, probably in the Centr. Prov. Fl. March-April. *G. nutans*, Roxb., is probably not specifically different.

Quisqualis indica, Linn.; Roxb. Fl. Ind. ii. 427; Wight Ill. t. 92 (*Q. villosa*, Roxb., *The Rangoon Creeper*),—is a large scandent shrub with showy flowers, first white, then blood-red or orange, in drooping racemes. Calyx-tube filiform, 3-4 in. long, bearing at the throat 5 elliptic-oblong petals. Fruit oblong, 1½ in. long, with 5 sharp angles or wings.—Burma, Indian Archipelago, grown in gardens throughout the greater part of India. Fl. May-Sept.

1. COMBRETUM, Linn.

Shrubs, generally climbing, with opposite, rarely verticillate petiolate membranous leaves, and polygamo-doicous flowers. Calyx-tube cylindrical or 4-5-angled, constricted above the ovary, with a campanulate 4-5-cleft deciduous limb. Petals 4-5, small, inserted between the calyx-lobes. Stamens 8 or 10, biseriate, with long slender filaments, and small didymous anthers. Ovary 1-celled, with a subulate style, and 2-6 pendulous ovules. Fruit coriaceous, often filled with spongy cellular tissue, 4-6-angled or 4-6-winged, 1-seeded.

1. **C. decandrum**, Roxb. Fl. Ind. ii. 232; Cor. Pl. t. 59.—Syn. *Poivrea Roxburghii*, DC.; W. & A. Prodr. 317. Vern. *Dhobela*, Chindwara; *Punk*, Gonda, Oudh.

A large climbing shrub; young leaves, branchlets, and inflorescence clothed with soft silky pubescence. Leaves glabrous, opposite, elliptic-oblong, acuminate, about 6 in. long on short petioles, with 6-8 main lateral arcuate nerves on either side of midrib. Flowers pentamerous and decandrous, on numerous cylindrical, terminal, and lateral bracteate spikes, forming a long panicle, the floral-leaves coloured. Bracts as well as peduncles and calyx clothed with soft ferruginous hairs. Fruit 1 in. long, with 5 equal broad obtuse membranous wings.

Common in Bengal, Behar, South India, Oudh, Kamaon, and the Central Provinces, chiefly in open jungle. Fl. Feb.-March; fruit June.

C. nanum, Hamilt.; Wall. Cat. 3994, is a small undershrub, vern. *Pharsia*, Kamaon, perfectly glabrous, with a thick woody prostrate stem. Common in grass-lands of the Doons, Siwaliks, and sub-Himalayan tract, from the Jumna to Sikkim, in the Oudh forests, in Behar, and the Central Provinces. Flowers ¼ in. long to end of stamens, in terminal and axillary spikes, bracts deciduous, leaves opposite, broad-obovate, 2-4 in. long, with 3-4 pair of main lateral arcuate nerves. The leaf- and flower-bearing stems are burnt down annually to the root by the fires. Fl. March, April.

2. **LUMNITZERA**, Willd.

Trees or shrubs with alternate, thick and somewhat fleshy leaves. Flowers white or red, nearly sessile, racemose. Calyx-tube oblong, a little prolonged beyond the ovary, with 2 adnate bractlets; limb campanulate, 5-lobed, persistent. Petals 5. Stamens 5-10; filaments filiform; anthers cordate. Ovary 1-celled, with 2-5 pendulous ovules. Fruit small, ovate-oblong, more or less compressed, bluntly angled, crowned by the persistent calyx, enclosing in a fibrous pericarp a hard osseous 1-seeded nut. Seed linear, cotyledons convolute.

1. **L. racemosa**, Willd.; W. & A. Prodr. 316.—Syn. *Petaloma alternifolia*, Roxb. Fl. Ind. ii. 372. Vern. *Kripa*, Beng.

A tree or tall shrub, perfectly glabrous, with spathulate fleshy crenate leaves 2 in. long, somewhat approximate near the ends of branches; lateral nerves 3-5 on either side of midrib, indistinct. Petals white. Stamens 10. Racemes (more correctly spikes, as the flowers are all but sessile) lax, longer than leaves, axillary, or from below the leaves.

On the edge of salt-water creeks and back-waters in the Sunderbunds, in Malabar and the Konkan; may possibly be found in Sindh. Found also on the Zambesi river, and in Australia. Wood strong and durable; used for building, and furnishes a large portion of the fuel for Calcutta (Roxb.)

3. TERMINALIA, Linn.

Trees or large shrubs with alternate or subopposite leaves, generally petiolate and entire. Flowers sessile, small, greenish or white, generally in long spikes, bisexual or polygamous. Calyx-tube ovoid or cylindrical, constricted above the ovary; limb campanulate or cylindrical, 5-toothed, deciduous. Petals wanting. Stamens 10, in 2 rows; anthers small, versatile, dehiscing longitudinally. Ovary inferior, 1-celled. Ovules 2, rarely 3, pendulous from the top of the cell. Fruit 1-seeded, the seed included in a coriaceous or osseous kernel; testa membranous; cotyledons convolute.

Fruit fleshy, ovoid, without wings.
  Leaves approximate near ends of branches; petiole longer than ⅓ blade of leaf. Spikes axillary, and below the leaves; bracts small, caducous . . . . 1. *T. bellerica.*
  Leaves distant, often subopposite; petioles shorter than ⅓ blade of leaf. Spikes terminal and axillary, often paniculate, bracts lanceolate or subulate . . . . . 2. *T. Chebula.*
Fruit coriaceous, with 3-7 longitudinal wings.
  All leaves subopposite; fruit large, with 5-7 thick narrow wings . . . . 3. *T. Arjuna.*
  Upper leaves often alternate; fruit large, with 5 thin broad wings . . . . 4. *T. tomentosa.*
  Upper leaves always alternate; fruit small, in large panicles, with 1 very large and 2 small wings . . . . . 5. *T. paniculata.*

1. **T. bellerica,** Roxb. Cor. Pl. t. 198; Fl. Ind. ii. 431; W. & A. Prodr. 313; Wight Ill. t. 91; Bedd. Fl. Sylv. t. 19.—Sans. *Tusha, baheruka.* Vern. *Bahera, bhaira,* Hind.; *Balra, balda,* Dekkan; *Behedo,* Mandevi; *Tahaka marra,* Gonds, C.P.; *Manjit* (the bearing tree), C.P. (R. Th.); *Tissein,* Burm.

A large tree, with slight soft rust-coloured pubescence on young branchlets and calyx. Leaves approximate at the ends of branchlets, glabrous, slightly pubescent when quite young, coriaceous, pale beneath, broad-elliptic, or obovate-elliptic, 3-8 in. long, base often unequal, apex obtuse, retuse, or short-acuminate, main lateral nerves arcuate, prominent, 5-8 on either side of midrib. Petiole longer than ⅓ length of leaf. Flowers sessile, dirty grey or greenish yellow, with a strong offensive smell. Spikes slender, interrupted, 3-6 in. long, on this year's shoots in the axils of leaves or below the leaves, male and bisexual flowers mixed. Bracts linear, very early caducous. Free part of calyx cup-shaped, cleft half-way into 5 acute triangular segments, woolly inside, with long brown hairs. Filaments inserted below the calyx-segments and twice their length. Fruit ovoid, grey, velvety, with 5 more or less indistinct furrows ¾ to 1 in. long; nut thick and hard. Roxburgh describes the petiole with 2 "opposite glands on the upper side of the apex, and sometimes near the base." I do not find any distinct glands on the specimens before me, and do not recollect having seen them in India.

Common in the plains and lower hills throughout India and Burma, but not found indigenous in the arid region which comprises Sindh, Western Rajputana, and the Southern Panjab. Along the foot of the Himalaya and in the outer valleys it extends nearly to the Indus, but is scarce near its western limit. Common in the Oudh Sāl forests. Sheds its leaves in Feb. and March; the new leaves come out in April. The young foliage is of a copper- or tan-colour. Fl. Feb.-May; the fruit ripens during the ensuing cold season.

Attains 80-100 ft., with a tall, straight, regularly-shaped trunk 6-10, and at times 16-20 ft. girth. Branches spreading, forming a broad massive crown. Bark ½ in. thick, dark grey, uneven and tesselated by broad longitudinal furrows, crossed by short narrow transverse wrinkles, the old bark exfoliating in dry corky scales. Wood light grey or yellowish, open- and coarse-grained, easily worked, but not durable. No distinct heartwood, the cub. ft. of green wood weighs 58-60, of seasoned wood 39-43 lb. Used for planking, packing-cases, canoes, and in the North-West Provinces for house-building after having been steeped in water. An insipid gum exudes from wounds in the bark. The fruit is a favourite food of monkeys, deer, sheep, goats, and cattle. It is one of the Myrobalans of commerce, and is used in dyeing cloth and leather, and in tanning, and is exported to Europe. Native ink is made of it, and it is used in medicine (Pharm. Ind. 88). The kernels are eaten, but are said to be intoxicating. Oil is expressed from them.

2. **T. Chebula**, Retzius—**Tab. XXIX.**—Roxb. Cor. Pl. t. 197; Fl. Ind. ii. 433; W. & A. Prodr. 313; Bedd. Fl. Sylv. t. 27.—Sans. *Haritaki.* Vern. *Har*, *Harra*, *harara*, Hind.; *Halra*, *Harla*, Dekkan; *Hir*, *Māhōka*, Gonds, Satpura range; *Pangāh*, Burm.

A large tree; young branchlets, leaf-buds, and youngest leaves with long soft shining, generally rust-coloured, sometimes silvery hairs. Leaves distant, mostly subopposite, ovate or oblong-ovate, acuminate, 3-8 in. long, main lateral nerves arcuate, prominent, 6-12 on either side of midrib. Petiole shorter than ⅙ length of leaf, 2 or more glands on the upper side of the petiole. Flowers sessile, dull-white or yellow, with a strong offensive smell. Spikes 2-4 in. long, often panicled, at the end of this year's shoots, terminal, above the leaves, and in the axils of the leaves. Bracts subulate or lanceolate, longer than flower-buds, falling after the flowers open. Free part of calyx cup-shaped, cleft half-way into 5 acute triangular segments, woolly inside with long brown hairs. Filaments more than twice the length of calyx-segments. Fruit obovoid from a cuneate base, sometimes ovoid, 1-1½ in. long, more or less distinctly 5-angled; nut thick and hard, with a rough surface, irregularly 5-grooved. *T. citrina*, Roxb. Fl. Ind. ii. 435, from East Bengal, leaves broad-lanceolate, with a tapering base; fruit elongate-obovoid, nut deeply 5-grooved, may possibly be a variety only.

Siwalik tract and outer Himalaya, ascending to 5000 ft., and extending west to the Sutlej. Common in Eastern Bengal, Behar, Central India, and South India. South of the Nerbudda I have always found it more common and of larger size at elevations above 2000 ft.—for instance, on the high lands of the Satpuras. Cultivated occasionally in the sub-Himalayan tract of the Panjab to the Indus. Sheds its leaves in Feb. and March, the new foliage comes out in April, the flowers appear shortly afterwards, and the fruit ripens January to March of the ensuing year.

In the Panjab generally a small tree 4-5 ft. girth, farther south and under favourable conditions, attains a large size, 80-100 ft., with a tall, straight, regularly-shaped stem 8-12 ft. girth. Bark ⅓-1 in. thick, dark-coloured, cracked and furrowed, woody scales exfoliating. Sapwood large, heartwood with an irregular outline, pale or dark brown, finely mottled, often with a yellowish or greenish tinge, hard, close-grained, and heavy. Regarding weight and transverse strength there is some uncertainty. Skinner gives the weight of the wood from the Peninsula at 54 lb. per cub. ft., R. Thompson (wood from the Satpura) at 63½. *Pangah* wood from Burma is said to weigh 58 lb. by Benson, 60 by Skinner, and the result of my experiments in 1864 was 66.3. But in 1861, when preparing a collection of woods for the Exhibition of 1862, I found the Burma wood to weigh 53 lb. only. As there is no reason to believe that the *Pangah* of Burma is a different species, the readiest explanation is, that the weight of the wood varies within wide limits—viz. between 53 and 66 lb. per cub. ft. So much is certain, that it is heavier than the wood of *T. bellerica*. The value of P. is given by Skinner (for South India wood) at 825, for Burma wood at 1032, which agrees with the result obtained by Benson (1033). My experiments with Burma wood (in 1864) gave 810, 1230, and 1230. *Pangah* wood has numerous fine medullary rays, the annual rings are fairly distinct, the pores are numerous in the inner (spring and summer) wood, and there is often a narrow belt of outer (autumn) wood without pores. It takes a good polish, and is fairly durable; it is used for furniture, carts, agricultural implements, and house-building. The bark is employed for tanning and dyeing. Hollow rounded galls to 1 in. diam. are formed on the young twigs; they are very astringent, used to make writing-ink, in tanning, and in dyeing. The galls are called *Halre-ke-phūl* in the Dekkan, and *Kadukai* in Tamil. The dried fruit are the Black Myrobalans of commerce (*Har, harra*). The dried unripe fruit is called *Bālhar, zangihar, kalehar* (Moodeen Sheriff Suppl. to the Pharm. of India 242), and many varieties of it are sold for tanning, dyeing, and as a medicine.

3. **T. Arjuna**, Bedd. Fl. Sylv. t. 28.—Syn. *T. Berryi* and *glabra*, W. & A. Prodr. 314; *Pentaptera Arjuna* and *glabra*, Roxb. Fl. Ind. ii. 438, 440. Sans. *Arjuna, kakubha* (Roxb.) Vern. *Anjun, arjūn, arjūna, anjani, arjan, kahūa, kawa, kowa, koha.* (*Arjuna sadra*, Guzerat.)

A large tree, with huge often buttressed trunk, smooth grey bark, and drooping branchlets; glabrous, inflorescence only slightly pubescent. Leaves generally subopposite, hard, coriaceous, oblong, 5-8 in. long, on short petioles, with 2 large, often cylindrical glands at the base of the leaf or on petiole, glabrous on both sides, pale brown beneath; main lateral nerves arcuate, 10-15 on either side of midrib. Flowers, like those of *T. tomentosa*, in cylindrical, pedunculate, terminal and axillary spikes, generally congregated into short panicles. Fruit 1-1½ in. long, with 5-7 equal, brown, hard, coriaceous, thick, narrow wings, less than ½ in. wide, indistinctly and irregularly marked with ascending cross-lines.

Common on the banks of rivers, streams, and dry water-courses in Central and South India and Bengal. Also in the Oudh forests. Farther west in the Siwalik tract and the outer Himalayan valleys, only here and there (Garhwal, Hardwar). In the Panjab it is cultivated (not indigenous), west to the Ravi. Fine specimens near Kangra. Fl. April, May; the fruit ripens in the cold season. The tree is never quite leafless.

Attains 80-100 ft., with a tall, large, but not regularly-shaped trunk, 40-50 ft. to the first branch, 10-20 ft. girth, with angular excrescences and huge buttresses. Crown handsome, close, large, oval; branchlets drooping. Bark greenish white, often green, or grey, slate-coloured or purplish, flaking off in large thin layers, showing a fresh green surface. Sapwood whitish, heartwood dark brown, very hard. Weight, 48-54 lb. per cub. ft. Value of P. 806-820. Apt to split in seasoning, not easy to work; used for carts, agricultural implements, and building. The bark, sold in the bazaars of South India, is in great repute as a tonic, and for external use on wounds.

4. **T. tomentosa,** W. & A. Prodr. 314; Bedd. Fl. Sylv. t. 17.—Syn. *T. crenulata* and *coriacea*, W. & A. Prodr. l. c.; *Pentaptera crenulata, coriacea*, and *tomentosa*, Roxb. Fl. Ind. ii. 438-440. Sans. *Asana.* Vern. *Sain, assain, assaina, arsain, asna, assan*, N.W. Ind.; *Ain, ayin*, Bomb.; *Sāj, sijra*, C.P.; *Mard marra*, Gonds, C.P.; *Sāg, hāg, Sāder, Saddr, Sādri, hādri*, Nimar, Guzerat, and adjoining parts of Meywar; *Matti, kari matti*, Canar.; *Taukkyan*, Burm.

A large tree, with a tall, regularly-shaped trunk. Bark rough, black, deeply cracked; young branches, inflorescence, and young leaves clothed with short, rust-coloured pubescence. Leaves hard, coriaceous, oblong or ovate, rarely obovate-oblong, 5-9 in. long, on short petioles, with 1-2 glands near the base of the midrib, soft-tomentose beneath or glabrous on both sides when full-grown; main lateral nerves arcuate, 10-20 on either side of midrib; the top leaves near the end of the branch generally alternate, the lower leaves subopposite. Flowers of a dull yellow colour, in erect terminal panicles, the lower branches in the axils of leaves. Bracts lanceolate, longer than buds. Free part of calyx-tube flat cup-shaped, hairy within, with 5 broad ovate acute segments. (Fl. all bisexual, Roxb.) Fruit 1½-2 in. long, with 5 broad, coriaceous, brown wings, ¾-1 in. broad, and as long as the fruit, marked with numerous, closely parallel, horizontal, prominent lines, running from the axis to the edges; edges of wings thin, irregularly crenulate. There is a marked variety with (always?) drooping branchlets, larger broad-ovate leaves, and very large fruit, 2 in. long, which merits further study. I have found it in Burma and (April 1863) in the Oudh forests between the Mohān and Sarda rivers, and it has been noticed in Kamaon and elsewhere. The bark, however, is the same as that of the ordinary form with oblong leaves.

A common tree in the moister regions of India. In the Siwalik tract and outer Himalayan valleys it goes west as far as the Ravi, and in places ascends to 4000 ft. In Western India its limit appears to be in the forests south-west of Neemuch, where several places (Sadri, Bara Sadri, Chota Sadri) seem to have derived their names from it. It is also found on the western edge of the Malwa table-land, east of the Bunass river (Bassi forests). East and south of these points it extends throughout Central, Eastern, Southern India, and Burma. Thrives best in heavy binding soils. Fl. April. The fruit ripens in Feb.-April of the ensuing year. Coppices fairly well. The tree bears long-continued pollarding. In the Sattara district along the line of Ghats, and east of the narrow belt of evergreen forest which fringes the edge of the Ghats, there is a broader belt of forest, mainly composed of deciduous trees, from 10-15 miles wide, where the system of cultivation has been for centuries periodically to cut the underwood, but to leave a certain number of standard trees, which are pollarded, every time the underwood is cut. The underwood is burnt with the branches of the pollards, and the ashes serve to fertilise the fields. The hills in that portion of the district are thus studded with numerous huge pollards, principally of *Terminalia tomentosa, bellerica, Careya arborea*, and *Lagerstrœmia lanceolata*;

and along the foot of the Ghats, in the contiguous portion of the Ratnagiri district, as far as there is any forest vegetation left, a similar system of cultivation prevails, and a large portion of the pollards are of *Terminalia paniculata,* in addition to the other trees mentioned.

T. tomentosa does not generally lose its leaves until Feb. March or April, but is one of the latest trees in the dry forest to come out in fresh leaf. Thus on the 1st May 1870, in the Sattara district, *Ain, Dhaura,* and *Moi* (*Odina Wodier*) were quite bare, whereas *Dopāli* (*Boswellia thurifera*), *Dhamun* (*Grewia vestita*), *Lendia* (*Lagerstrœmia parviflora*), *Kumbi* (*Careya arborea*), *Dhaivan* (*Cordia Macleodii*), were in full leaf or coming into leaf.

Attains 80-100 ft., trunk straight, symmetrical, 40-50 ft. clear to the first branch, 8-10 ft. girth. In Burma the tree attains much larger size—80 ft. to the first branch, and a girth of 12 ft., being the average size of full-grown trees on good soil. A small knotty tree when kept down by lopping. Bark 1-2 in. thick, dark grey, nearly black, irregularly tesselated by deep and wide longitudinal furrows, and smaller transverse cracks, thick quadrangular plates exfoliating. Inner bark red. Sapwood whitish or yellow. Heartwood dark brown, mottled with darker streaks, often nearly black, hard. Medullary rays numerous, very fine. Pores small, surrounded by irregular, narrow, more or less concentrically arranged lines of whitish patches. The cub. ft. of seasoned wood weighs 60 lb. on an average, the extremes ranging between 50 and 70 lb. There is no difference in weight between the Burma and Indian wood. The green wood weighs between 70 and 80 lb. per cub. ft. The mean value of P. is given by Skinner at 860, which is a fair average of the numerous experiments made with this wood by different authors and in different parts of India—the extremes being 591 and 1104. Baker's figures alone range considerably lower; 4 experiments made with *Assan* from the Jainaghar (Jynaghur) timber agency, weighing 61.6 lb. on an average, gave the mean value of P. at 677. But Puckle's experiments with *Matti* wood from Mysore (weight 55.75 lb.) gave an average of 1010; and my experiments in 1864 with *Taukkyan* wood from Burma (weight 56.43) gave a mean value of 903. It is for further inquiry whether the wood of this tree from North India has less transverse strength than that from Burma and the South. The wood does not season readily, and is apt to warp and crack; its grain is coarse and curly, and it is not easily worked. Its durability is most uncertain. In Burma the heartwood decays rapidly; in North India beams and kurries are at times found to last well, and at other times they perish from dry-rot and are eaten by insects. It is used largely in North and Central India for house-building, for carts, rice-pounders, ship- and boat-building. It is an excellent fuel, yielding a powerful heat, and furnishing good charcoal. Potash is in places made of it. The bark is used for tanning, and the ashes of the bark are chewed with the Betel-leaf. The common Tasar (tussah) silkworm feeds on the leaves, and the tree is on that account pollarded (where not protected) all over the Satpura forests. Lakh is occasionally gathered on the branches, and in Oudh and the North-West Provinces the leaves are lopped for cattle-fodder. The flowers are often attacked by a *cynips*, producing numerous small peppercorn-like galls on the flower-stalks, which are persistent and remain a long time on the tree, in the place of the fruit which is not formed.

5. **T. paniculata,** W. & A. Prodr. 315; Bedd. Fl. Sylv. t. 20.—Syn. *Pentaptera paniculata*, Roxb. Fl. Ind. ii. 442. Vern. *Kinjal, kindal*, Konkan; *Honal*, Canara.

A large tree, nearly glabrous; inflorescence, bracts, and ovary rusty-tomentose. Leaves coriaceous, pale-brown beneath, oblong, acuminate,

from a cordate or rounded, often unequal base, 4-7 in. long, on short petioles; main lateral nerves 10-15 on either side of midrib. The upper leaves always alternate, the lower subopposite. Flowers on slender spikes in large spreading panicles; bracts ovate, long-acuminate, recurved. Ovary cylindrical or ovoid; free portion of calyx reddish brown, globose in bud, afterwards cup-shaped, with long brown hairs inside. Fruit ¼-½ in. long, sessile, close-set in large spreading panicles, with 2 smaller and 1 large wing, the latter transversely oblong, ¼-½ in. long, and ¾-1 in. broad.

Common in the forests along the western coast; rare above Ghat in the latitude of Bombay. I do not know it north of the Konkan, and have not noted it from the Khandeish Dangs and the Mandevi forests; but it may be found in the Nerbudda valley. Fl. Aug., Sept.; the fruit ripens in March, April. The timber is useful, makes good planking, and is fairly durable. The handles of ploughs in the Ratnagiri district are made of *Kindal* and *Ain*.

4. ANOGEISSUS, Wall.

Trees with alternate, petiolate, entire leaves, and small bisexual flowers in globose heads on slender peduncles. Calyx-tube compressed, 2-winged at the base, prolonged above the ovary into a narrow, often slender tube, expanding at the top into a campanulate deciduous 5-cleft limb. No petals. Stamens 10, biseriate; filaments filiform, exserted; anthers small, cordate, versatile, dehiscing longitudinally. Ovary 1-celled, with 2 pendulous ovules. Fruit small, coriaceous, broadly 2-winged, imbricated in globose heads, rostrate by the persistent calyx-tube. Seed ovoid; cotyledons convolute.

Leaves oval ovate or ovate-lanceolate, beak as long as or longer than fruit.	
Leaves oval or ovate; flower-heads in fascicles or short racemes; peduncles as long as or shorter than heads	1. *A. latifolia.*
Leaves ovate-lanceolate, flower-heads solitary; peduncles as long as or longer than heads	2. *A. acuminata.*
Leaves obovate, beak shorter than fruit	3. *A. pendula.*

1. **A. latifolia**, Wall.; Bedd. Fl. Sylv. t. 15.—Syn. *Conocarpus latifolia*, Roxb. Fl. Ind. ii. 442; W. & A. Prodr. 316; Wight Ic. t. 994; Royle Ill. t. 45. Vern. *Dhau*, *dhauri*, *dhaura*, *dāwa*, *dhāwa*, *dohu*, *bākli*, *bankli*. Local names: *Gōlra*, *gōldia*, *dhaukra*, *dhōkri*, *dāu*, Rajputana; *Khardhāwa*, Banda; *Dindaga*, *dindal*, Canar; *Siri mānu*, Tel.

A large tree, with smooth, white-grey bark; young trees with spinescent branches; branchlets and young leaves with soft silky pubescence. Leaves coriaceous, subopposite, on short petioles, oval or ovate, rarely ovate-lanceolate, obtuse retuse or emarginate, glabrous when full-grown; 2-4 in. long; main lateral nerves arching, 6-10 on either side of midrib. Flower-heads in short axillary racemes; peduncles as long as flower-heads or shorter. Wings of fruit nearly orbicular, glabrous, persistent calyx-tube (beak) slightly pubescent, as long as or longer than the fruit.

Common and often gregarious in the deciduous forest of South and Central India. In the sub-Himalayan forests west to the Ravi, ascending to 3000 ft. Aravalli hills. (A variety with small silky-pubescent leaves, 1½ in. long, not uncommon in the Central Provinces.) Bare during most part of the dry season. From November the foliage begins to have a fine copper-tint, is generally shed in February, and the new leaves come out in May. Fl. May-June, sometimes later (Jan. Feb., Roxb.) The seed ripens Nov.-Feb. Coppices vigorously. Suffers from frost. In January 1870, on the borders of Pertabgarh, south-west of Nimach, I found that it had been injured a good deal, *Acacia Catechu* had suffered less, and *A. leucophlœa* not at all. In North India attains 60-70 ft., with a tall, erect trunk, often deeply fluted, and 30-40 ft. to first branch, girth 6-9 ft., in habit and appearance not unlike *Lagerstrœmia parviflora.* Bark thin, smooth, white, greenish-white or cinereous, with slate-coloured patches. Thin whitish flakes exfoliating. Inner bark purplish, compact. Wood light- or dark-brown, variegated with darker veins, the centre wood of old trees often very dark. A handsome wood, close- and even-grained, compact, hard, very tough and elastic. A cub. ft. of the seasoned wood weighs between 57 and 65 lb., and 75-80 lb. while green. Its average transverse strength is given by Skinner as P.=1220, but other authors give a lower figure. Thus the average of 3 experiments by Puckle (Mysore wood) is 870, and of 3 experiments made by J. B. French at the workshops of the Madras railway was 752. The determination of the transverse strength, therefore, demands further experiments. So much, however, is certain, that the wood is highly valued on account of its great strength and toughness. It is universally used for axe-handles, poles for carrying loads; in many parts of India the axles of native carts are made of it, which stand heavy weights on rough roads.* But it warps and splits in seasoning, and unless kept dry is not very durable. It is used extensively for construction, furniture, agricultural implements, and for shipbuilding. It is valued next to *Teak, Sāl, Bija sāl,* and *Asna.* It makes good charcoal, and yields excellent fuel. From incisions in the bark a fine white hard gum is obtained (*dhauri-ka-gond*), similar to gum-arabic, employed in cloth-printing, like that of *Odina Wodier,* and sold extensively. In Meywar and Kamaon the leaves are used for tanning.

2. **A. acuminata,** Wall.; Bedd. Fl. Sylv. t. 16.—Syn. *Conocarpus acuminata,* Roxb. Fl. Ind. ii. 443; W. & A. Prodr. 316. Vern. *Pāchi mānu, panchman, paunchinan,* Telugu; *Yungben,* Burm.

A large tree, with rough dark-grey bark and pendulous branchlets; branches, leaves, peduncles, and calyx clothed with soft, adpressed tomentum. Leaves subopposite, on short petioles, ovate- or oblong-lanceolate, 1½-2½ in. long. Flower-heads solitary, ¾ in. across, when in flower, on slender, axillary, often reflexed peduncles; sometimes branching, often with a few small leaves or bracts. Free part of calyx-tube elongated, tomentose. Peduncles as long as or longer than heads. Fruit with wings broader than long, glabrous; edge of wings irregularly dentate; persistent calyx-tube hirsute, longer than fruit.

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* The carts, which carry timber and Bamboos from the Barreea forests to the great timber-mart of Reyna near the Mye river, on the borders of Guzerat, have axles and linch-pins of *Dhaura,* the boss, nave and fellies of *Bia* (*Pterocarpus Marsupium*), the spokes of *Khair* (*Acacia Catechu*), the yoke of *Teak,* and the pole of *Ougeinia dalbergioides.* On the other hand, the carts which come up from the open country of Guzerat have axle and linch-pin of iron, the nave of *Rohin* (*Soymida febrifuga*), bound with iron, and fellies, spokes, the yoke-pole, and platform of *Babul* (*Acacia arabica*).

Burma and Northern Circars. Godavery forests. A tree which Mr R. Thompson in 1870 found on the Nagpahar in the Mandla district, and (abundantly) on the Pachmarhi plateau, vern. *Khardi*, was referred to this species by Dr Stewart; but I have not seen any of the specimens collected by Mr Thompson, and am therefore unable to decide whether it is this or the following species. R. Thompson's description states, "The cones of this species are much larger than those of *C. latifolia*," which would point to *C. acuminata*, and not to *C. myrtifolia*, the cones of which are smaller. He further describes it as a tree of moderate size, bark smooth, whitish, occasionally rugose and exfoliating, dusky. Many-branched and well clothed with dense foliage. Leaves considerably smaller than those of *C. latifolia*. Coming into fresh leaf about May, buds and young leaves covered with a beautiful silvery tomentum. Fl. in May; seed ripens Jan.-Feb.

In Burma *A. acuminata* is a large tree, 12 ft. girth, trunk regularly shaped, 80 ft. to the first branch on good soil. The wood is greyish brown, with orange or dark-brown streaks, hard, warps and cracks in seasoning. Medullary rays very numerous and very fine. Pores numerous, small, uniformly distributed. Weight of a cub. ft. 50-59 lb. P. = 880 (Skinner).

3. **A. pendula**, Edgeworth Catalogue of Plants in the Banda district, p. 47.—Syn. *A. myrtifolia*, Wall. Cat. No. 4017; Royle Ill. p. 209. (The latter name is older, but Edgeworth was the first to describe the tree.) Vern. *Dhao*, *Dhaukra*, *kala dhokra*, Meywar; *Kardahi*, Gwalior.

A small gregarious tree, with pendulous branches, and light adpressed pubescence on leaves and branchlets. Leaves alternate and subopposite, obovate, obtuse or mucronate, ½-1 in. long, narrowed into a short slender petiole, with 5-7 pairs of arcuate lateral nerves joined by elegant reticulate venation. Flower-heads small, ¼ in. across when in flower; free part of calyx-tube short, pubescent. Fruit with narrow wings, nearly orbicular; persistent calyx-tube shorter than fruit.

Common in Rajputana and Bandelkhand, extends north to the banks of the Jumna, and south to the Mye river; has been found near Deesa (Stocks). The small-leaved Conocarpus on the Pachmarhi plateau is probably this species. (Forsyth gives *Conocarpus myrtifolia* from the Satpuras under the vern. name of *Kardahi*, as not very common, with reddish-white wood.—The Highlands of Central India, p. 462.) On dry hills only a shrub, under more favourable circumstances a moderate-sized tree. Trunk short, 3-5 ft. girth, branchlets drooping. In January, when the tree is in fruit, the foliage has a beautiful reddish-brown colour similar to the foliage of Beech in autumn. This tree forms forests on the hills of Meywar, near Humirgarh, Bassi, Chittor, and other places, either pure or mixed: Often associated with *Conocarpus latifolia*, *Casearia*, and a few other trees. Many of these forests of *A. pendula* are strictly preserved, among others the forest which clothes the lower slopes of the Chittor fort, and numerous temple forests in that part of the country. It is also found on the dry gneiss hills of Mairwara near Todgarh. The tree coppiice well, and as it thrives in the dry districts of Central India its requirements merit careful study. Experiments with the wood, grown in Gwalior, were made by Cunningham—the cub. ft. was found to weigh 59 lb., the value of P. in 5 experiments ranged between 697 and 1034, average 837.

ORDER XXXVII. MYRTACEÆ.

Trees or shrubs, with simple, generally entire leaves, in most genera dotted with translucent glands, opposite or alternate, without stipules. Flowers regular and generally bisexual. Calyx-tube adnate to the ovary, limb free, 4 - 5 - cleft, often closed in bud, and bursting into irregular lobes, or coming off entire. Disc coating the calyx-tube. Petals 4-5, sometimes none, inserted on the edge of the disc, in bud imbricate, sometimes more or less connate into a caducous calyptra. Stamens perigynous, generally numerous, inserted on or inside the edge of the disc, in one or several rows; filaments free, or connate at the base in a short ring or tube, or in bundles generally opposite the petals; anthers 2-celled, versatile or basifixed, the cells mostly dehiscing longitudinally. Ovary syncarpous, inferior, rarely adnate at the base only, either 1-celled, or more often with 2 or more cells; style simple; stigma small, capitate or peltate; ovules numerous. Seeds generally without albumen.—Gen. Pl. i. 690; Royle Ill. 216; Wight Ill. ii. 6.

- **Leaves dotted with resinous glands, generally opposite.**
  - **Calyx truncate, the orifice closed by a deciduous operculum; fruit hard and woody; leaves of young shoots opposite, of flowering branches alternate . . . . . 1. EUCALYPTUS.**
  - **Calyx generally lobed; leaves opposite; fruit fleshy.**
    - **Free portion of calyx entire, bursting irregularly or coming off entire . . . . 2. PSIDIUM.**
    - **Free portion of calyx 4-5-lobed . . . . . 3. EUGENIA.**
- **Leaves not dotted with resinous glands, alternate.**
  - **All stamens antheriferous; fruit dry . . . . 4. BARRINGTONIA.**
  - **A portion of stamens only antheriferous; fruit fleshy . 5. CAREYA.**

1. EUCALYPTUS, L'Héritier.

Shrubs or trees attaining sometimes a gigantic size, secreting more or less of resinous gums, whence their common appellation of "Gum-trees;" often flowering when quite young and small. Leaves in young saplings generally horizontal, opposite, sessile, and cordate; in the adult tree mostly vertical, alternate, petiolate, and passing more or less from broadly ovate to lanceolate, acuminate, and falcate, always rigid. Flowers in umbels or heads, usually pedunculate. Calyx-tube adnate to the ovary, truncate, the orifice closed by an operculum (formed of the concrete petals and calyx-lobes?), generally thick, fleshy or woody, covering the stamens in the bud, and falling off entire when the stamens expand. Stamens numerous, in several series. Ovary inferior, the summit glabrous, flat convex or conical, 3-6-celled, with numerous ovules in each cell, on an axile placenta. Fruit consisting of the more or less enlarged truncate calyx-tube, usually of a hard and woody texture, interspersed with resinous receptacles. The fertile seeds are often, but not in all species minute; the embryo has broad-cordate 2-lobed or bipartite cotyledons folded over the straight radicle, but otherwise flat. A large proportion of the seeds are often abortive, and these are generally enlarged, variously shaped, and of a hard and uniform texture.

Numerous species have been introduced into India; they grow with great rapidity, and the timber is much valued in Australia. It will here suffice to mention two species as representatives of those which are commonly called in Australia *Blue Gum* and *Stringy-bark.*

Leaves of old trees 4-6 in. long; flowers small, umbellate; fruit 3-5 lines diam. . . . . 1. *E. obliqua.*
Leaves 6-12 in. long; flowers large, sessile; fruit 9-12 lines diam. 2. *E. Globulus.*

1. **E. obliqua,** L'Hér.; Benth. Fl. Austral. iii. 205.—Syn. *E. gigantea,* Hook. f. Fl. Tasm. i. t. 28. *Stringy-bark.*

An immense tree, attaining from 150 to 250 ft. with a very tenacious rugged, fibrous bark, flaking off in stringy masses. Leaves of young trees opposite, of flowering branches alternate, ovate-lanceolate, falcate, and very oblique at the base, more or less acuminate, 4-6 in. long, with oblique distant, anastomosing veins, inserted along the midrib, and intramarginal veins at some distance from the edge. Peduncles axillary or lateral, bearing each an umbel of about 4-12 flowers. Operculum shorter than calyx-tube. Stamens ¼ in. long, all perfect; anther-cells diverging or at length divaricate and confluent at the apex. Fruit more or less pear-shaped, truncate at the top, 3-5 lines diameter; capsule more or less sunk. Seeds minute.

This kind of Stringy-bark forms vast forests in Victoria and South Australia, and is abundant in Tasmania, forming a great part of the hill forests, and ascending to 4000 ft. Specimens have been felled in the valleys at the base of Mount Wellington, Tasmania, 300 ft. high and 100 ft. in girth. Has been introduced extensively on the Nilgiris, and on a smaller scale, by way of experiment, in the Panjab, and in several places of the North-West Himalaya.

2. **E. Globulus,** Labillardière; Benth. l. c. 225; Paxton's Flower Garden, ii. 38, fig. 153. *Blue Gum.*

A lofty tree, attaining 350 ft. Foliage when crushed of a powerful almost offensive smell. Young shoots and foliage glaucous-grey. Leaves of the young tree opposite, sessile and cordate; of the full-grown tree lanceolate or ovate-lanceolate, acuminate, falcate, often 6-12 in. long, with oblique, conspicuous anastomosing veins, all inserted along the midrib, and intramarginal veins at some distance from the edge. Flowers large, axillary, solitary or 2-3 together, closely sessile on the branch or on a peduncle not longer than thick. Calyx-tube broadly turbinate, thick, woody, more or less ribbed or rugose, ½-¾ in. diameter. Operculum shorter than calyx-tube. Stamens above ½ in. long; anthers ovate with parallel cells. Fruit semiglobular, ¾-1 in. diameter; capsule nearly level with the rim. Seeds minute; 10,000 sifted fertile seeds per ounce (F. v. Mueller).

Gregarious in Victoria and the south of Tasmania. Introduced on the Nilgiris and (experimentally) in the Panjab. Cultivated in the plantations made in the south of France (near Nice) on barren hills. Growth extremely rapid while young (9 ft. girth in twenty years on the Nilgiris). Heartwood brown, hard, tough, durable, takes a fine polish. The leaves are used as a febrifuge in Australia.

The *yarrah* wood of Western Australia (*E. rostrata*, Schlechtendal, Benth. l. c. 240) is a very strong and durable wood, but apt to crack and split unless thoroughly seasoned. It is said to resist white ants and the Teredo navalis, and has been imported to India for railway-sleepers. The *Red Gum* of Australia is the produce of several species, especially of *E. resinifera*, Smith, Benth. l. c. 245. It is nearly allied to Kino, is largely imported into Europe, and is used in medicine (Pharm. Ind. 71). Several ethereal oils (*Eucalyptus oil, Mali oil*) are distilled from the leaves of other species, and form an important article of export. Thus there are many reasons why the cultivation of those species of *Eucalyptus*, which will thrive in India, deserves to be encouraged.

2. **PSIDIUM**, Linn.

Trees or shrubs, with opposite leaves; peduncles axillary, 1- or few-flowered; flowers large. Calyx-tube ovate, adnate at the base, the upper free portion quite entire, closed in the bud, at length irregularly bursting into lobes or coming off entire. Petals 4 or 5, free. Ovary 2- or more-celled, with many ovules in each. Fruit a many-seeded berry. Seeds with a hard testa; embryo curved with a long radicle and short cotyledons.

1. P. **Guava**, Raddi; Grisebach West Ind. Fl. 241.—Syn. *P. pomiferum*, Linn. Bot. Reg. t. 1079, with globose; *P. pyriferum*, Linn., with obovate fruit. The *Guava-tree*. Vern. *Amrūt*, *amrūd* (the Persian name for Pear), *Safri-ām*, North-West India; *Piyāra*, Beng.

A small tree or large shrub, young branches pubescent. Leaves oblong or elliptic-oblong, 4-6 in. long, on very short petioles, pubescent beneath, nearly glabrous above, with 15-20 pairs of prominent main lateral nerves, arcuate near the edge, and joined by prominent intramarginal veins. Peduncles axillary, 1½-1 in. long, with 1-3 flowers. Free part of calyx ovoid in bud, larger than the ovoid ovary, bursting into irregular lobes. Petals ½ in. diam. or more. Fruit globose or obovoid, inside red white or yellowish.

Indigenous in Mexico, and possibly in other parts of tropical America, cultivated and naturalised in most tropical countries. In India cultivated almost everywhere, except in the north-western corner of the Panjab. Often run wild, but there is no ground for supposing that the Guava is indigenous in India. Wood compact, close-grained, takes a beautiful polish.

Nearly related is the Myrtle, *Myrtus communis*, Linn.; Boissier Fl. Orient. ii. 736—Vern. *Vilāyati mehndi*, *mūrad*—indigenous in the Mediterranean region, and often cultivated in India; evergreen, wholly glabrous, with small ovate acuminate leaves; white flowers; small black berries; free part of calyx-tube short, regularly 4-5 cleft. Leaves used in native medicine.

3. **EUGENIA**, Linn.

Evergreen trees or shrubs, with opposite, penniveined leaves; the flowers tetramerous (Indian species), rarely pentamerous, in lateral or terminal trichotomous cymes or panicles. Calyx-tube from globular to narrow-turbinate. Stamens numerous, in several series, free or obscurely collected in 4 bundles; anthers versatile, usually small, the cells opening longitudinally. Ovary 2-celled, rarely 3-celled, with several ovules in each cell. Fruit a berry with 1 or few seeds; testa membranous or cartilaginous; embryo thick and fleshy with a very short radicle; the cotyledons either united in an apparently homogeneous mass, or more or less separable.

Flowers large, in short 4-8-flowered terminal cymose racemes .	1. *E. Jambos.*
Flowers small in trichotomous panicles arising from the previous year's wood below the leaves.	
Leaves coriaceous, lateral nerves close together . . .	2. *E. Jambolana.*
Leaves subcoriaceous, lateral nerves distant	3. *E. operculata.*

1. **E. Jambos**, Linn.; Roxb. Fl. Ind. ii. 494.—Syn. *Jambosa vulgaris*, W. & A. Prodr. 332; Wight Ic. t. 435. The *Rose-apple.* Sans. *Jambu.* Vern. *Gulāb jāman.*

A moderate-sized tree, quite glabrous. Leaves coriaceous, entire, lanceolate, 5-8 in. long, narrowed into short petioles; lateral nerves distant, joined by prominent intramarginal veins. Flowers tetramerous, large, white, 1-1½ in. to tip of stamens, on pedicels ½ in. long, in short cymose terminal racemes, composed of 2-4 pair of opposite flowers (1-flowered cymes), the uppermost opening first. Calyx-tube turbinate, edge free, somewhat produced above the ovary; lobes round, obtuse. Fruit subglobose, 1-2 in. long, crowned with the persistent calyx-lobes.

Only cultivated within the range of this Flora, rare in the Panjab. Indigenous in the Sikkim Terai. Cultivated in many tropical countries. Fl. Feb.; fruit ripens July, Aug. Trunk short; bark thin, grey, with shallow furrows, inner substance reddish, compact, brittle. Wood reddish brown. The tree is planted for shade and ornament, and on account of its fruit, the size of a small apple, with a delicate rose-water perfume, but dry and hardly worth eating.

2. **E. Jambolana**, Lam. — **Tab. XXX.** — Bedd. Fl. Sylv. t. 197; Roxb. Fl. Ind. ii. 484.—Syn. *Syzygium Jambolanum*, W. & A. Prodr. 329, often called the *Black Plum.* Sans. *Jambu, jambula.* Vern. *Jām, jāman, jamni, phalāni, phalinda, pharenda, phaunda, paiman.*

A moderate-sized tree, wholly glabrous. Leaves coriaceous, shining, entire, oval oval-oblong or lanceolate-oblong, generally long-acuminate, 3-6 in. long, narrowed into petiole ½-1 in. long; lateral nerves numerous, close together, parallel, confluent near the margin, but not forming regular prominent intramarginal veins. Flowers greenish, tetramerous, small, numerous, ¼-⅓ in. to tip of stamens, nearly sessile, in 3-flowered cymes (sometimes by abortion 1- or 2-flowered), arranged in broad trichotomous panicles, lateral on the previous year's wood, rarely terminal, the ultimate cymes approximate at the end of each branch of the inflorescence, forming rounded fascicles of flowers. Calyx-tube funnel-shaped, the upper part campanulate, produced above the ovary; lobes very short. Petals cohering and falling off in a calyptra. Berry oblong or subglobose, ½-1 in. long, crowned with the base of the cup-shaped calyx, purple or black, succulent, smooth when ripe. Exceedingly variable in the shape of its leaves, the size of the fruit, and also in other respects. In Wight's Icones the following are figured as forms of the same species: *E. Jambolana*, t. 535, with large loose spreading panicles and oblong 5-seeded fruit; *E. caryophyllæfolia*, Lam. t. 553; Roxb. l. c. 486, with ovate-lanceolate, long-acuminate leaves and globose fruit; *E. obtusifolia*, Roxb. l. c. 485, t. 620, with obtuse leaves and oblong 1-seeded fruit.

Common throughout India, excepting the arid region of Sindh, and the southern Panjab. In the sub-Himalayan tract and outer hills extends west nearly to the Indus, and ascends to 3000 ft. (Panjab), 5000 ft. (Kamaon). Generally in moist places near rivers and water-courses, but also on high ground, and often associated with Sāl. Commonly cultivated in India, also in other tropical and sub-tropical countries. In Queensland, New South Wales, and the Indian Archipelago, indigenous or cultivated. Fl. March, April; the fruit ripens in June, July. The leaves are renewed in March, the flush of the young leaves coming out with a bright copper-colour. (In the Panjab the tree is not evergreen, the old leaves are shed in January and the new foliage comes out from March to May.—J. L. S.)

Attains 70-80, at times 90 ft.; trunk not tall, and not very straight, but often 20 ft. clear to first branch; girth 6-8, at times 12-15 ft. Branches spreading and ascending, with drooping branchlets, forming a close shady crown—a great relief in the hot months in the otherwise leafless forest. Foliage dark green; leaves shining, aromatic. Bark 1-1½ in. thick, corky, light or dark grey. Inner bark pale reddish-brown, compact, fibrous. Heartwood reddish-brown, tough and hard. Weight 43-48 lb. per cub. ft. when seasoned, 63 when green. Value of P. 600 (Skinner). Annual layers visible. Warps in seasoning, but is fairly durable. Used much for building, agricultural implements, for well-curbs, and well-steps, where it is considered almost indestructible. Boats and canoes are made of it. The bark is used for dyeing and tanning. The fruit is much eaten by natives: in appearance it resembles a damson, has a harsh but sweetish flavour, somewhat astringent and acid. Is much eaten by birds; a favourite food of the large bat (flying fox). A kind of vinegar is prepared from it, which is used in diseases of the spleen. Grows quickly at first, but slowly afterwards. Young plants suffer from frost in the Panjab plains.

Nearly allied to *E. Jambolana*, is *E. salicifolia*, Wight Ic. t. 539, *Syzygium salicifolium*, Graham Cat. Bomb. Pl. p. 73, Dalz. Bomb. Fl. p. 94, with narrow lanceolate leaves, and small white flowers in lax panicles from the old wood below the leaves; a shrub or tree, common gregariously on the banks of the Koina river, and in other valleys of the Sattara Ghats, identified by Beddome, Fl. Sylv. p. 109, with a narrow-leaved Eugenia growing in the bed of the Nerbudda river, near Jubbulpur.

3. **E. operculata**, Roxb. Fl. Ind. ii. 486; Wight Ic. t. 552.—Syn. *Syzygium nervosum*, DC. P. iii. 260. *Eugenia nervosa*, DC.; Bedd. Fl. Sylv. Manual, p. 106 (but not *E. nervosa*, DC. P. iii. 284, which is a different tree from Cochin-China). *E. cerasoides*, Roxb., and *E. Paniala*, Roxb. l. c. 488, 489, probably refer to the same tree. Vern. *Rāi jāman*, *jamawa*, *paiman*, N.W.P.; *Jāman*, *dūgdūgia*, Oudh.

A middle-sized tree, wholly glabrous. Leaves subcoriaceous, broad-ovate or elliptical, 3-8 in. long, 2-4 in. broad, obtuse or shortly acuminate, narrowed into petiole, ¼-1 in. long, with 8-12 pairs of main lateral slightly arcuate nerves, very prominent below, intramarginal veins generally not prominent. Flowers tetramerous, small, greenish, odorous, nearly sessile, in 3-flowered cymes, arranged in broad lax trichotomous panicles, with spreading or divaricate branches, arising from the leafless nodes of the previous year's wood. Calyx campanulate, with short obtuse marginate teeth. Petals cohering and falling off in a calyptra. Berry globose or ovoid, $\frac{1}{4}$-$\frac{1}{2}$ in. long, with but little mark of calyx, rugose, very juicy.

Sub-Himalayan forests from the Jumna to Assam, ascending to 2000 ft. Oudh and Gorakhpur forests, Chittagong, Burma, the western coast, and Ceylon. Outside India in South China and the Indian Archipelago. The fruit is eaten, and the tree is planted for its fruit. The leaves are renewed in April, the old leaves turning red before they are shed. Fl. April, May. The fruit ripens in June, July. In dry places a scrubby tree 35 ft. high and 5 ft. girth, but under favourable conditions grows to be one of the largest and most handsome trees of the genus. Bark 1 in. thick or more, cinereous, brown or blackish, rough with irregular hard scales, leaving cavities when they exfoliate. Inner substance red, fibrous. Sap-and heart-wood similar, brown, close- and fine-grained. Tough and durable, seasons and polishes well. Used in Kamaon and Garhwal for building and agricultural implements. The fruit is eaten.

4. BARRINGTONIA, Forst.

Trees with alternate leaves, usually approximate at the ends of branches. Flowers in terminal or lateral spikes or racemes, with small deciduous bracts. Calyx-tube ovoid or turbinate, not at all or scarcely produced above the ovary. Petals 4 or 5, adhering at the base to the staminal ring. Stamens indefinite, in many series, connate at the base into a short ring or cup; anthers small, versatile or fixed near the base. Ovary inferior, with an annular disc on the top within the stamens, 2-4-celled; 2-8 ovules in each cell; style filiform, with a small stigma. Fruit pyramidal ovoid or oblong, hard and fibrous, indehiscent. Seed solitary, with a thick testa; albumen none. Embryo thick, fleshy, consisting of two concentric homogeneous masses, the central mass corresponding to the pith, the outer to the bark, both separated by a thin layer of delicate vessels and fibres, corresponding to the woody portion of stem and root. Cotyledons rudimentary, scale-like. On the structure of the seeds of Barringtonia and Careya, see Thomson in Journ. Linn. Soc. ii. 47.

1. **B. acutangula**, Gärtner Sem. ii. t. 101; Bedd. Fl. Sylv. t. 204; Roxb. Fl. Ind. ii. 635; W. & A. Prodr. 333.—Vern. *Samundar phūl*, *panniāri*, *ingar*, Oudh; *Kanapa chettu*, Telugu.

A moderate-sized tree, with obovate or oblanceolate leaves, entire or serrulate, narrowed into a short petiole, glabrous, pale beneath, 3-5 in. long. Flowers red, in long slender pendulous racemes; bracts oblong, very deciduous. Ovary 2-celled, with 2 pendulous ovules in each cell. Fruit oblong, 4-angled, 1 in. long or longer.

Common on banks of streams, edges of swamps, and in moist places generally, in South India, Burma, Bengal, the Oudh forests, and the sub-Himalayan tract, extending west to the Jumna. Also Indian Archipelago and North

Australia. Leaves shed and renewed March, April. Fl. May; fr. Sept.-Oct. Attains a height of 30 and a girth of 5 ft., with a short trunk, and large crooked spreading branches. Bark 1 in. thick, cinereous or brownish black, rough with longitudinal reticulate cracks and furrows, and irregularly oblong exfoliating scales. Wood pale or reddish-brown, turns black if buried in mud, fine-, close-, but short-grained, hard, tough, strong, weight of cub. ft. 56 lb. (Skinner), 39.4 (Kyd); value of P. 315 (Kyd), 648 (Benson, green wood), 863 (Skinner). Said to be durable. No distinct heartwood. Used for boat-building, in wells, for carts, rice-pounders, and by cabinet-makers. The pounded bark is used to intoxicate fish; mixed with chaff and pulse, it is given as cattle-fodder.

5. CAREYA, Roxb.

Trees or undershrubs, with alternate leaves approximate near the ends of branches, and large showy flowers. Calyx wholly adnate to the ovary, ovoid or turbinate, with a 4-cleft limb. Petals 4, spreading. Stamens very numerous, in several rows; filaments distinct above, united at the base into a thick fleshy ring, inserted with the petals; the exterior and interior stamens generally without anthers, the middle row antheriferous; anthers small, versatile, dehiscing longitudinally. Ovary 4-celled, with numerous ovules attached to axile placentas; style filiform; stigma capitate, obscurely 4-lobed or -toothed. Fruit globose, with a thick rind, numerous seeds embedded in a fleshy pulp. No albumen. Embryo large, almond-like, structure similar to that of Barringtonia.

A large tree; flowers sessile . . . . 1. *C. arborea.*
An undershrub; flowers pedunculate . . . . . . 2. *C. herbacea.*

1. **C. arborea,** Roxb. Cor. Pl. t. 218; Wight Ill. t. 99, 100; Bedd. Fl. Sylv. t. 205, Anal. t. 18 ii.; W. & A. Prodr. 334. Vern. *Kumbi kūmbh, Khumbi.* Gond. names: *Kumri,* Chindwara; *Gumar,* Mandla, Balaghat.

A large tree, wholly glabrous. Leaves obovate-oblong, membranous, sessile or narrowed into short marginate petiole, crenate, with 10-12 pair of prominent main lateral nerves. Flowers large, sessile, a few together at the ends of branchlets, white and pink, with an unpleasant smell. Fruit globose, green, 3 in. across, crowned with the persistent calyx-segments.

Common in South India, Bengal, and Burma. Sparingly found in the forests of the Central Provinces, Oudh, and in the sub-Himalayan tract, where it extends west a little beyond the Jumna. Grown here and there in gardens in the Panjab. (In North Australia and Queensland a tree is found nearly related to this, *C. arborea,* var. *australis,* Benth. Fl. Austr. iii. 289.) Bare during part of the dry season, the new foliage appears in March, April. Fl. with the young leaves; fr. ripens and falls about July.

Under favourable circumstances attains a height of 50, and a girth of 8 ft., but in Central and North India is generally a much smaller tree. Bark 1-2 in. thick, dark grey, or dark brown, smooth or rough, with large exfoliating scales. Inner bark red, very fibrous. Sapwood yellowish white, large, heartwood dull red, or reddish brown, beautifully mottled, even-grained, hard and strong, does not season well, is apt to split, but takes a fine polish. The weight of a cub. ft. of seasoned wood is given by Skinner at 50 lb., and this may probably be accepted as a fair average, though it seems to fluctuate between wide limits, the extremes being 35 and 60.75. My experiments with Burma wood gave 55 in 1862, 50.58 and 60.37 in 1864. The average of 9 experiments made by me in 1864 was P.=768, the extremes being 645 and 950; Skinner gives it at 870, which is probably somewhat too high. I am inclined to accept 800 as the mean value of the coefficient of transverse strength, with regard to the results of all experiments available to me. Annual rings fairly distinct, medullary rays very numerous, very fine, pores scanty, in oval groups of 3-6, uniformly distributed. Each annual ring marked by a narrow ring of darker wood. The wood is not much used in North-West India, save for agricultural implements. In South India and Burma used for cart-building. The bark is used as an astringent in native medicine. From the inner bark fuses for matchlocks are made, by pounding, cleaning, drying, and twisting it into a thin cord. These are said to burn at the rate of 12 inches per hour. Coarse strong cordage is also made of the bark.

2. **C. herbacea,** Roxb. Cor. Pl. t. 217.

A small undershrub; a thick woody root-stock producing annually a herbaceous stem 12-in. high, with cuneate leaves, and a number of pedunculate large beautiful pink flowers which appear in spring.

Grass lands in Bengal, Oudh, and the Central Provinces.

ORDER XXXVIII. LYTHRARIEÆ.

Herbs, shrubs or trees with simple entire leaves, generally opposite, sometimes alternate or verticillate. Stipules none. Flowers bisexual, generally regular. Calyx free, campanulate cylindrical or hemispherical; lobes 4-8, valvate in bud, and often with as many intermediate, usually exterior teeth or appendices. Petals generally isomerous and alternate with the calyx-lobes, obovate, often corrugated in the bud, sometimes wanting, inserted inside the limb of the calyx. Stamens usually definite, perigynous; filaments inflected in the bud; anthers 2-celled, dehiscing longitudinally. Ovary free, usually 2-4-celled, cells with numerous ovules attached to an axile placenta; style simple, persistent. Fruit a capsule, 2-4- or many-celled, or by obliteration of septa 1-celled. Seeds numerous without albumen, embryo straight with a short radicle.—Gen. Pl. i. 773; Royle Ill. 208 (*Granateæ*), 212; Wight Ill. i. 204 (*Salicarieæ*), ii. 2 (*Granateæ*).

Ovary free; leaves with black dots or glands beneath; calyx-tube curved	1. WOODFORDIA.
Ovary free; leaves without dots or glands; calyx-tube straight.	
Calyx-lobes 4; petals 4; stamens 8	2. LAWSONIA.
Calyx-lobes 6; petals 6; stamens numerous	3. LAGERSTRŒMIA.
Ovary inferior; fruit with a hard coriaceous rind, crowned by the persistent calyx	4. PUNICA.
Ovary partially adnate to calyx; fruit fleshy, base and sides adnate to the persistent calyx; leaves thick	5. SONNERATIA.

1. WOODFORDIA, Salisbury.

Calyx tubular, coloured, slightly curved and widened at the mouth, which is oblique, and has 6 small equal deltoid lobes, and as many external short appendices, persistent in fruit, expanding and generally split below. Petals 6, alternate with the calyx-lobes, linear-lanceolate, minute. Stamens 12, inserted near base of calyx, much exserted; anthers ovate, versatile. Ovary 2-celled; style filiform, exserted. Capsule 2-celled, 2-valved, with numerous small seeds, covered with the persistent calyx.

1. **W. floribunda**, Salisb.; Boissier Fl. Orient. ii. 737.—Syn. *Grislea tomentosa*, Roxb. Cor. Pl. t. 31; Fl. Ind. ii. 233; W. & A. Prodr. 308. Sans. *Dhātri pushpika, Agnivāla* (the flame of fire). Vern. *Dāwi, tāwi, tāwa, dhā, thāwi, sautha, dahāi, dhae, dhaura, dhaula.* Local names: *Dhewtie*, Oudh; *Dhuvie, surtāri*, C.P.; *Pitta marra*, Gonds, C.P.

A large shrub, with long spreading branches, pubescent, young branchlets and leaves with numerous small black glands. Leaves opposite or subopposite, sometimes in whorls of 3, sessile, 2-4 in. long, ovate-lanceolate from a cordate or rounded base, with 6-10 prominent arcuate lateral nerves on either side of midrib, joined by distinct intramarginal veins. Flowers on slender pedicels dilated above, shorter than calyx, with a few bracts at base, in axillary clusters. Length of style and stamens vary in this plant, as noticed for *Lythrum Salicaria* in Oliver's Ind. Bot. 213.

Common throughout India, beyond the Indus at Peshawar, and in Beluchistan. Ascends to 5000 ft. in the N.W. Himalaya. Fl. Feb.-April. 10 ft. high or more, bark smooth, peeling off in thin scales, wood pale nut-brown, close-grained, used as fuel. In the north-west the flowers are collected for export to the Panjab, for dyeing silks. The flowers secrete much honey.

2. LAWSONIA, Linn.

Calyx short, broad-turbinate, deeply cleft into 4, broad-ovate lobes, without appendices. Petals 4, sessile, corrugated in bud, inserted on a raised ring at the top of the calyx-tube. Stamens 8, inserted in pairs between the petals, sometimes 4 only; filaments subulate; anthers broad-oblong, the cells attached to a thick connective. Ovary globose, 4-celled; style filiform; ovules numerous, adnate to thick axile placentas. Capsule globose, supported at the base by the persistent calyx, pericarp brittle, bursting irregularly. Seeds truncate, cuneate or pyramidal, with a thick testa; cotyledons flat, orbicular; radicle short.

1. **L. alba**, Lamarck; Boissier Fl. Orient. ii. 744; Wight Ill. t. 87; W. & A. Prodr. 307.—Syn. *L. inermis*, Linn.; Roxb. Fl. Ind. ii. 258. *L. spinosa*, Linn. The *Henna plant of Egypt.* Sans. *Mendhi.* Vern. *Mendi, mehndi.*

A glabrous shrub, with angular branchlets sometimes spinescent, and opposite, sessile coriaceous small leaves, elliptic or obovate-elliptic, from a cuneate base; about 1 in. long. Flowers greenish yellow, very fragrant, ¼ in. across, on short slender pedicels, in large terminal paniculate cymes.

Indigenous in Beluchistan, on dry hills of the Coromandel coast, and perhaps in Central India. Cultivated throughout India for its leaves, and as a hedge-plant. Probably indigenous in North Africa, Arabia, and Persia. Cultivated in most tropical and subtropical countries. Fl. throughout the year. Grown from seed and cuttings. The leaves are powdered and made into a paste which is used to dye nails, skin, and beard. Regarding its cultivation in the Amballa district, see Edgeworth Jour. As. Soc. vii. 754.

3. LAGERSTRŒMIA, Linn.

Trees and shrubs; leaves opposite or the uppermost alternate, petiolate, oblong or ovate, entire. Flowers in axillary or terminal panicles. Calyx-tube short, broadly turbinate, cleft into 6 ovate lobes. Petals 6, inserted between the calyx-lobes, clawed. Stamens numerous, inserted at the bottom of the calyx-tube; filaments long exserted, filiform; anthers versatile. Ovary sessile, 3-6-celled; style filiform; ovules numerous, attached to axile placentas. Fruit an oblong, coriaceous capsule, girt at the base by the persistent calyx, 3-6-celled, dehiscing loculicidally into 3-6 valves; dissepiments and placentæ attached to the middle of the valves. Seeds winged, with a membranous testa; cotyledons orbicular; radicle cylindrieal.

1. **L. parviflora**, Roxb. Cor. Pl. t. 66; Fl. Ind. ii. 505; Bedd. Fl. Sylv. t. 31; W. & A. Prodr. 308.—Vern. *Bākli, dhaura, Kat dhaura:* N.W.P.; *Lendia, leindia, seina,* C.P.; *Sidda, āsid,* Oudh and Mirzapore district; *Shej,* Banda; *Kākria, kākrio,* Banswara and Guzerat.

A large tree, glabrous, only youngest branches and leaves slightly pubescent. Leaves coriaceous, opposite, sessile or very shortly petiolate, oblong or ovate, with 6-10 prominent, arcuate lateral main nerves on either side of midrib. Flowers white, fragrant, ¼ in. across, on slender pedicels in panicles, few or many flowered. Calyx even, not ribbed, pubescent, the 6 outer stamens much longer than the rest. Capsule ovoid or cylindrical, ¾-5/4 in. long, 3-4-celled. Seed with a terminal wing, longer than seed, the whole ¾ in. long, ¼ in. broad in the middle, with a straight thin edge on the inside, and a thick curved bark on the outside.

Common in Central India, Bandelkhand, Behar, Bengal, the Oudh forests, and the sub-Himalayan tract to the Jumna, ascending to 3000, and occasionally to 5000 ft. Banswara, Guzerat. South India (frequent in Mysore and on the east side). The old leaves shed in March, April, the young foliage comes out in May. Fl. April-June; fruit ripens in August, and remains long on the tree.

In North and Central India attains 50-70 ft., and a girth of 6-8 ft., with a straight clean stem, often 30-40 ft. to the first branch. Grows well from seed, coppices readily, the shoots growing rapidly into tall straight poles. Bark ½-1 in. thick, light ash-coloured, almost white, even, smooth, rarely marked with few shallow furrows, flaking off in dark-coloured scurfy pieces, leaving exposed the inner lighter-coloured layers. Wood light brown or yellowish, often with a reddish tinge, and mottled, smooth- and even-grained. Heartwood darker, but not sharply defined. Pores large; numerous whitish wavy concentric bands in the wood; annual rings not distinct. The cub. ft. weighs 40-50 lb. Elastic, tough, and of great transverse strength. Seasons well, works freely, and takes a fine polish. Fairly durable. Used extensively, and valued highly for ploughs and other agricultural implements, and for construction. Buggy-shafts and axe-handles are made of it. A sweet gum exudes from wounds in the bark, and is eaten. Bark and leaves are extensively employed for tanning.

L. lanceolata, Wall.; Bedd. Fl. Sylv. t. 32.—Vern. *Bandāra, nandi, nāna, nāni*, Western Ghats, a common tree in the forests on the west side of the Peninsula as far north as Khandeish, is similar to *L. parviflora*, but is readily distinguished by petiolate, ovate, acuminate leaves, which are bluish white beneath; larger flower-panicles, the calyx and pedicels clothed with dense grey pubescence, calyx-segments reflexed, and small capsules $\frac{1}{3}$-$\frac{1}{2}$ in. long. (The large capsules figured by Beddome do not apparently belong to this species.)

L. indica, Linn.; Wight Ill. t. 86; a handsome shrub from China, with large white or purple flowers; petals long-clawed and much curled. Is cultivated in gardens.

L. Reginæ, Roxb. Cor. Pl. t. 65; Bedd. Fl. Sylv. t. 29; is a large, bulky, and valuable timber-tree with large showy lilac flowers, in moist forests of Eastern Bengal, Burma, the western coast of the Peninsula, and at the foot of the Ghats, extending north as far as the Ratnagiri district, where it is called *Taman*.—Vern. *Jarūl*, Bengal. *Pymma*, Burm. It differs from the three first-named species by the calyx longitudinally ribbed and furrowed, by all stamens being of equal length, and a large 6-celled ovoid or globose capsule. The wood is red, not heavy, and fairly strong, the cub. ft. weighs between 36 and 47 lb., and the average value of P. ranges from 600-850. It is used extensively for ship-building at Chittagong, and in Burma.

4. **PUNICA**, Linn.

Ovary inferior; calyx coriaceous, persistent, prolonged above the ovary, free part campanulate, cleft into 5-7 valvate lobes. Petals as many as calyx-lobes, inserted at the mouth of the calyx-tube, crumpled in bud. Stamens numerous, inserted at different heights below the petals; filaments distinct; anther-cells attached to a large ovoid connective. Style filiform; stigma capitate. Fruit large, globose, crowned by the somewhat tubular limb of the calyx, indehiscent, divided in 2 tiers or divisions, the lower 3-celled, the upper 5-9-celled; dissepiments membranous; placentæ in the lower division at the bottom of the cells, in the upper stretching from the side of the fruit to the middle. Seeds numerous, nestling in a pellucid pulp. Embryo oblong; radicle short, acute; cotyledons foliaceous, spirally convolute.

The structure of the fruit is remarkable. The bud in its youngest state shows a thick concave disc, closed by the valvate sepals or calyx-lobes. At the bottom of the disc appear the carpels, in two circles; at its edge the petals, alternating with the calyx-lobes, and the space between petals and carpels is occupied by numerous rows of stamens. The carpels of the outer circle appear first, they are 5-9; the number of the inner carpels is generally 3, sometimes 5. These carpels coalesce, and the upper portions uniting, form the style. Each carpel has numerous ovules, which originally appear at the bottom of its cavity. Meanwhile the sides of the concave disc keep on growing, finally the outer carpels are raised, and form the upper division of cells in the fruit, while those of the inner ring remain at the bottom, and form the lower tier or division. The position of the placentæ also is somewhat changed through the expansion and altered position of the carpels. The ripe Pomegranate may be compared to the fruit of a Rose, with this difference, that in the Rose the carpels are more numerous, that they do not coalesce, though the styles sometimes do, and that they are 1-seeded. This brief indication of a most curious structure is intended to elicit further researches on the development of the ovary in the Indian genera of Rosaceæ, Myrtaceæ, and Lythrarieæ (*Sonneratia* and *Duabanga*). With regard to Punica, there should be consulted, besides Lindley's Vegetable Kingdom, and Wight's Illustrations, Agardh. Syst. Plant. 1858, t. xii.; Griffith Notulæ, iv. p. 641, Ic. t. 634; Payer Organogenie Comparée de la Fleur, Paris, 1857, p. 465, t. 99; Berg in Martius Fl. Brasiliensis, Myrtaceæ, p. 6, t. 8, 9. Punica is an anomalous genus, with some affinity to Myrtaceæ, but is separated from that order by the valvate calyx and other characters.

1. **P. Granatum**, Linn.; Roxb. Fl. Ind. ii. 499; W. & A. Prodr. 327; Wight Ill. t. 97. The *Pomegranate.* Sans. *Dalima;* Arab. *Rumān;* Pers. *Anār.*—Vern. *Anār* (tree and fruit), *dārim, dālim, dāl, daru, dhāru, darnu.*

A shrub or small tree, deciduous, glabrous, often with spinescent branchlets. Leaves opposite or subopposite, often fascicled, on short petioles, oblong, quite entire, not dotted. Flowers sessile, terminal, solitary or in 3-flowered cymes, usually scarlet, rarely white or yellow.. Fruit 2-3½ in. diam., with a coriaceous rind; pulp red, in some varieties white. Seeds angled.

Wild, common in Eastern Afghanistan and Beluchistan to 6000 ft. Hills west of Sindh to 4000 ft. East flank of Suliman range between 3500 and 6000 ft. Not uncommon in the Panjab Salt range, and in parts of the North-West Himalaya. Abundant in Kamaon (wild ?) at elevations between 2000-6000 ft. Believed also to be indigenous in Syria. Run wild in Greece (Fraas Syn. Pl. Fl. class. 79). Cultivated extensively in many parts of India, in Western Asia, the Mediterranean region, and in many subtropical countries of the Old and the New World.* New leaves (in India) Feb., March; fl. chiefly April, May, but also at other seasons; the fruit ripens from July-Sept. Easily raised from cuttings; growth slow (18 rings per in. radius).

Rarely over 20 ft. high, with a short trunk attaining 3-4 ft. in girth; bark yellowish or dark grey. Wood whitish or yellowish white, close- and even-grained, hard, heavy, takes a fine polish. Several varieties of the fruit are cultivated in Kashmir, but the best Pomegranates are imported into India from Afghanistan; those of Jellalabad are valued most. The bark of the root is an excellent vermifuge, and is considered a specific against the tape-worm (Pharm. Ind. 93). The rind of the fruit, *nāspāl*, Pb. *chandi, chowdi, kūshiāla*, Sindh, is extensively used as a dye- and tan-stuff; from the flowers a light-red dye is made. Morocco leather is tanned and dyed with the bark of the tree.

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* The Pomegranate, the Fig, and the Vine are frequently mentioned in the Old Testament (*e. g.*, Deut. viii. 8). The Pomegranate occurs in the Odyssey; its name (*ῥοιά*) is supposed to suggest an affinity with the Hebrew and Syrian name *Rimmon.* There seems no doubt that the tree is not indigenous in Greece, and that its cultivation was originally introduced from Syria. Of the Latin names, *mala granata, quæ punica vocantur,* the first is explained by the number of seeds (*a granorum multitudine*), the second indicates that the fruit, or at least some of the better kinds, was brought from North Africa. The Pomegranate is not, however, indigenous in North Africa, and was probably brought to Carthage from Phœnicia.

5. SONNERATIA, Linn. f.

Glabrous trees or shrubs, with opposite, petiolate, thick leaves. Flowers large, solitary or in 3-flowered cymes. Calyx thick, the tube broadly campanulate, adnate to the ovary at the base; lobes 4-8, without appendices. Petals 4-8, narrow or none. Stamens numerous, inserted at the top of the calyx-tube, inflected in the bud. Ovary enclosed in, and partially adnate to the calyx-tube, depressed-globose, 10-15-celled; style elongated with a small capitate stigma. Fruit large, depressed, fleshy and indehiscent, surrounded by the persistent calyx, and adnate to it at the base. Seeds immersed in pulp, angular with a thick testa. Cotyledons oily.

1. **S. acida**, Linn. f.; Roxb. Fl. Ind. ii. 506; W. & A. Prodr. 327; Wight Ic. t. 340.

A small tree, with drooping branches and petiolate, broadly ovate or obovate leaves, generally with cuneate base. Calyx-segments about 1 in. long. Petals purple, linear, scarcely exceeding the calyx. Fruit 1-2 in. diam.

In salt marshes and creeks. Delta of the Indus, western coast, Sunderbans, and Burma coast. Also on the east coast of Africa, and in North Australia. Wood used as fuel (Grah. Cat. Bomb. 72).

ORDER XXXIX. SAMYDACEÆ.

Trees or shrubs, with simple, petiolate, alternate, distichous leaves, and small deciduous stipules. Flowers inconspicuous, regular, generally bisexual. Calyx coriaceous, persistent, gamosepalous, lobes 3-7, imbricate or valvate. Petals perigynous, none or as many as calyx-lobes, alternate with them and similar to them in substance. Stamens definite or indefinite, often alternating with barren staminodes; anthers 2-celled, the cells dehiscing longitudinally. Ovary free, rarely adnate to the calyx-tube, syncarpous; ovules attached to 3-5 parietal placentæ. Fruit a capsule, 1-celled, generally 3-5-valved, rarely indehiscent. Seeds generally few, with a coriaceous or crustaceous testa, and copious fleshy albumen.—Gen. Pl. i. 794; Royle Ill. 170.

1. CASEARIA, Jacq.

Trees or shrubs with alternate, distichous leaves; stipules small lateral. Flowers fasciculate, small, green or yellow, on articulate bracteate pedicels. Calyx-tube short, with 4-6 imbricate lobes. Petals none. Stamens 6-15, alternating with an equal number of barren staminodes, and usually connate with them into a short tube or ring. Ovary free, narrowed into a short style; ovules numerous, attached to 3-4 parietal placentæ. Capsule 3-4-valved, seeds numerous, attached to the middle of the valves. Seeds with a fleshy aril; albumen fleshy; embryo straight; cotyledons flat; radicle terete.

Tomentose; stipules minute; leaves oblong or ovate-oblong . 1. *C. tomentosa.*
Glabrous; stipules ¼ in. long; leaves elliptic . . . . 2. *C. graveolens.*

1. **C. tomentosa**, Roxb. Fl. Ind. ii. 421.—**Tab. XXXI.**—Syn. *C. elliptica*, Willd.; Wight Ic. t. 1849. Vern. *Chilla, chilāra, bairi, bhāri.* Local names, *Tondri mara*, Gonds, C.P.

A small tree; leaves and branchlets tomentose. Leaves oblong, or ovate-oblong from an oblique base, serrate, 3-7 in. long, on short petioles; 8-10 main lateral nerves on either side of midrib, joined by prominent parallel transverse veins; stipules small. Flowers tomentose, greenish yellow, on pedicels somewhat longer than calyx, numerous, in compact axillary fascicles. Calyx 4-5-cleft. Stamens 8; staminodes hairy. Fruit ovoid, ¾ in. long, somewhat fleshy, 5-6-ribbed, 3-valved, on short pedicels, solitary, or few together in lateral fascicles. Seeds embedded in a scarlet soft mass, consisting of the agglomerate arils.

Common in Central India, Behar, the Oudh forests, and the sub-Himalayan tract as far as the Indus. Also in Eastern Bengal, South India and Ceylon. The leaves shed Jan.-March; new leaves appear March, April. Fl. Jan.-May, generally about April.

Generally not exceeding 30 ft., with a short trunk, attaining a girth of 4 ft.; on good soil (frequently in the Baraitch division of the Oudh forests), attaining 40 ft., and 7-9 ft. girth, R.T. Bark nearly 1 in. thick, cinereous, with white specks, or blackish brown by age, smooth, with longitudinal wrinkles, with rough furrows in old stems. Wood dirty white, or yellowish, even-grained, compact, hard, strong and elastic, 48 lb. per cub ft., R.T. Apt to split in seasoning, does not warp, and works smoothly. Heartwood not distinct, employed for ordinary purposes, not much valued, combs are made of it. All parts of the tree are very bitter; in Kamaon the pounded bark is used for adulterating the *Kamela* powder of *Rottlera tinctoria.* The pounded fruit yields a milky, acrid juice, used for poisoning fish.

2. **C. graveolens**, Dalzell; Kew Journ. of Bot. iv. 107 (1852); Bombay Fl. 11.—Vern. *Chilla, nāro, aloāl, kathera, pimpri*, North-West India; *Girchi, tūndri*, C.P.

A shrub or small tree, glabrous; leaves elliptic, dentate, 4-8 in. long, on short petioles; 8-10 main lateral nerves on either side of midrib; stipules ½ in. long, falcate or lanceolate, deciduous. Flowers green, numerous, with a disagreeable odour, clustered in the axils of the leaves, glabrous; pedicels very short. Calyx-lobes 5. Stamens 8, alternating with acute penicillate scales (staminodes). Fruit oblong, shining, 3-valved; seeds 12.

Abundant in the Oudh forests (associated with Sāl), also in the Central Provinces, the Konkan, and Canara. In the sub-Himalayan tract as far west as the Chenab, locally and sparingly only, ascending to 5000 ft. The leaves are shed in March and April, and renewed in May. Not higher than 20 ft., girth 12-15 in. Bark dark cinereous, with white specks, even, with a few longitudinal wrinkles. Wood light-yellow, fine-grained; the fruit is used to poison fish.

Homalium, Jacquin, is another genus of this order, distinguished by a half inferior ovary, styles 3-5, calyx-lobes and petals 6-7, flowers in slender axillary racemes or terminal panicles.

1. *H. tomentosum*, Benth.; Linn. Journ. iv. 34.—Syn. *Blackwellia tomentosa*, Vent. *Myaukshaw*, Burm. A large tree with smooth white bark (too smooth

for monkeys, the Burmese name), large subsessile obovate leaves, tomentose beneath, and flowers in axillary racemes. Burma. Java.

2. *H. nepalense*, Benth.—Syn. *Blackwellia nepalensis*, Wall. Pl. As. rar. t. 179, with ovate, petiolate, glabrous leaves and paniculate flowers, Nepal.

ORDER XL. PASSIFLOREÆ.

Herbs, shrubs, rarely trees, with alternate leaves with or without stipules. Flowers regular. Stamens definite; anthers 2-celled, dehiscing longitudinally. Ovary free, 1-celled, with numerous ovules, attached to 3-5 parietal placentæ. Fruit dry or fleshy with numerous seeds, covered with an arillus or pulpy integument, testa coriaceous or crustaceous; embryo large, with foliaceous cotyledons, enclosed in a fleshy albumen.—Gen. Pl. i. 807; Royle Ill. 220 (*Papayaceæ*); Wight Ill. ii. 33.

The principal genus of this family is *Passiflora*, comprising a large number of species, mostly American, and a few Indian, herbaceous or perennial climbers, with axillary tendrils, showy bisexual flowers, with a stalked ovary; stamens adnate to the gynophore, and a ring with filiform appendages arising from the calyx-tube. The genus *Carica* belongs to the tribe *Papayaceæ* with unisexual flowers and no ring or corona.

1. CARICA, Linn.

Soft-wooded trees or shrubs with milky juice, stem generally simple, or with few branches, leaves at the ends of branches. No stipules. Flowers in axillary racemes or panicles, uni- or bi-sexual. Calyx small, 5-lobed. Corolla in the male flowers gamopetalous, 5-lobed; in the female flowers, of 5, linear-oblong deciduous petals. Stamens 10, inserted in the mouth of the corolla, those opposite to the lobes on short filaments, those alternate with them sessile; anthers adnate to the filaments, 2-celled, dehiscing longitudinally. Ovary free, ovules numerous, attached in 2 rows to 5 parietal placentæ. Fruit fleshy, sulcate, indehiscent with numerous seeds. Embryo straight, in a fleshy albumen; cotyledons flat, oblong.

1. **C. Papaya**, Linn.; Roxb. Fl. Ind. iii. 824; W. & A. Prodr. 352; Wight Ill. t. 106, 107.—Vern. *Papaya, pepiya.*

A small soft-wooded, fast-growing, and short-lived tree, with large glabrous palmatifid and palminerved leaves, 12-24 in. across, on long hollow petioles, forming a round tuft at the top of the stem. Flowers on axillary panicles, pale yellow, fragrant, generally dioicous, but occasionally a few female flowers on a male plant. Male flowers in long drooping panicles. Female flowers in short clusters. Ovary 1-celled. Stigma sessile, 5-lobed, lacerated. Fruit succulent, indehiscent, 1-celled. Seeds numerous, black, enclosed in sweet mucous pulp, and covered with a loose hyaline skin or arillus; testa thick, brittle.

Indigenous in Brazil, and probably also in Central America and the West Indies. Cultivated throughout South India, Burma, and Bengal; in North-West India as far as Saharanpur and Delhi. The Papaya must have been introduced into India at an early date after the discovery of America, for in 1626 seeds were brought to Naples from India (De Candolle Geogr. Bot. ii. 917). The Indian name of the plant is derived from that under which it was known in America (*Papaw, papay*), and the Burmese name of *Thimbawthī* (fruit brought by sea-going vessels) is a further confirmation of its foreign origin. In flower and fruit nearly throughout the year, bears fruit 18 months after sowing. The unripe fruit is eaten as a vegetable and preserved, the ripe fruit is sweet and very pleasant, the seeds are pungent. Meat becomes tender by washing it with water impregnated with the milky juice, or by suspending the joint under the tree.

Tetrameles nudiflora, R. Brown; Bedd. Fl. Sylv. t. 212—Syn. *T. Grahamiana*, Wight Ic. 1956—is a large deciduous tree, of the Order *Datisceæ*. Fl. yellow, small, dioicous; male flowers in erect panicles, crowded at the ends of branchlets; female flowers in pendulous racemes. Calyx 5-cleft; petals none; stamens 4; styles 4. Capsules small, many-seeded, dehiscent at the top. Leaves cordate, long-petiolate, tomentose beneath. Fl. Feb.-March, while leafless. Burma. Western coast from Bombay southwards. Wood soft.

ORDER XLI. CACTEÆ.

Perennial plants, often arborescent, with succulent stems of anomalous form, flat, lobed, columnar, ovoid or globular. Leaves minute, scale-like, rarely perfect; epidermis of the younger parts of stem and branches green and furnished with pores. Flowers usually large and handsome, sessile, solitary, bisexual and regular. Calyx-tube adnate to the ovary; limb short or tubular; lobes numerous, on the margin only, or covering the entire surface of the ovary. Petals numerous, inserted at the mouth of the calyx, the outer conform to the calyx-lobes. Stamens indefinite, filaments filiform, long; anthers ovate, versatile. Ovary inferior, syncarpous, 1-celled; ovules numerous, on parietal placentæ; style terminal, simple; stigma radiating. Fruit succulent, 1-celled. Seeds numerous.—Gen. Pl. i. 845; Royle Ill. 223; Wight Ill. ii. 48.

1. OPUNTIA.

Branches flat, jointed, the joints ovate, obovate, or oblong, bearing tufts of spines or bristles. Leaves small, very caducous, under each younger tuft. Flowers arising from the tufts or margins of the joints, yellow or reddish. Calyx-tube not prolonged beyond the ovary; lobes numerous, the outer scale-like or foliaceous, adnate to the ovary, the inner short, flat. Petals numerous, connate at the base, spreading. Stamens indefinite, in many series; filaments shorter than petals, free or connate. Style cylindric, thicker below, constricted at the base; stigma with 2-7 thick erect branches. Fruit pyriform, umbilicate at the top, tubercled, and often having spines. Seeds with a hard osseous testa, foliaceous cotyledons, and copious or scanty albumen.

1. **O. Dillenii**, Haworth; W. & A. Prodr. 363; Wight Ill. t. 114.—Syn. *Cactus indicus*, Roxb. Fl. Ind. ii. 475. *Prickly Pear.* Vern. *Nāgphana* (the hood of a serpent), *nāgphansi*, Hindi; *Chappal sēnd*, Dekkan.

Erect, with numerous spreading branches, often 10-15 ft. high, gregarious, forming extensive and impenetrable masses of thorny, fleshy, articulate stems; joints obovate, flat, 6-10 in. long, glaucous-green, with minute, cylindrical or conical, fleshy, caducous leaves under each tuft on the youngest joints. Tufts on the surface of the joints about 1-2 in. apart, nearer together on the edges, subglobose, nearly ¼ in. diam., consisting of dense woolly hairs, and numerous short, very sharp spinescent brownish bristles; one or several strong, sharp cylindrical spines from each tuft, unequal in length, one much longer than the rest, 1-2 in. long. Spines whitish, except the point, which is darker coloured and somewhat transparent. Flowers from the upper edge of the joints, 2-3 in. across, yellow, tinged with red, open during the day only. Stamens half the length of petals.

Indigenous in America, but naturalised in India, extending north-west to the Jhelam. Ascends to 5000 ft. in the N.W. Himalaya. Often destroyed locally by the multiplication of a species of *coccus;* thus at Almora in 1846 (Madden l. c. 585), and in 1844 in the Panjab (Stewart Panjab Plants, p. 101). Forms impenetrable hedges, and was used by Tippoo Sultan to strengthen his fortifications. Was planted as a fence along portions of the Great India Peninsula Railway in the Dekkan; but is too much exposed to injury from fire, the grass which grows up abundantly between the stems drying up during the hot season, and catching fire readily, which destroys the entire hedge. Is regarded as an objectionable weed in most parts of India, as it harbours reptiles and spreads rapidly, occupying ground without return. The joints strike root, but its rapid extension is mainly due to the spread of the seed through birds which eat the fruit.

Three species of the genus, closely allied to the Indian species, are naturalised in the Mediterranean region; but it is a subject for farther inquiry whether they should be kept distinct as species, and whether any of them may be identified with the Indian Opuntia. The history of the distribution of these remarkable plants from America over such a large portion of the warmer regions of the Old World merits farther study on the part of Indian and Mediterranean botanists, and it may not be out of place here to state a few of the leading facts.

Boissier (Voyage Botanique dans le Midi de l'Espagne, 1837, ii. 229) mentions *Opuntia vulgaris*, Mill. only, as growing in the Mediterranean region, but adds that in Granada there are two forms, distinct by the length of their spines, leaving it undecided whether they are species or varieties. Grisebach (Vegetation der Erde, i. 322) enumerates three species, and under these may be brought all forms described by Visiani (Flora Dalmatica, 1842, iii. 143), Gussone (Floræ Siculæ Synopsis, 1842, i. 549), Tenore (Sylloge Fl. Neapolitanæ, 1831, p. 239), Webb (Hist. Nat. des Iles Canaries, 1840, iii. i. p. 209), and Lowe (Flora of Madeira, 1868, p. 313).

a. O. Ficus Indica, Mill.—Syn. *Cactus Opuntia inermis*, De Candolle Plantes Grasses, t. 138. Erect, 8-12 ft. high, joints oval or obovate, 1 in. thick, and more than 12 in. long, with short thick tufts of pale or yellowish bristles, without spines, or with feeble weak spines, or with one strong sharp spine. Flowers yellow; fruit prickly outside, eatable, 3-4 in. long. Abundant in North Africa, Syria, the South of Europe (Madeira and the Canaries?). The fruit, which ripens from July to Sept., forms an important article of diet for the inhabitants of those countries. Indigenous in Jamaica and South Florida, where the fruit is also eaten. The introduction of this sp. into India has been suggested (Royle

Ill. 223). Called *Opuntia Ficus Indica* by Visiani and Gussone, *O. vulgaris* by Tenore. Webb calls *Ficus Indica* the principal species in the Canaries, but Lowe refers this and the Madeira Opuntia to *Opuntia Tuna*, Haw. (*Cactus Tuna*, Linn.) Whatever the correct name for the Opuntia on those islands may be, it is important to state that this is the species employed in the Canaries for raising Cochineal. The first introduction of the insect 30 or 40 years ago was violently opposed by the country people, especially in Teneriffe, on the ground of its rendering the *Tuneras*, or plants of Opuntia, barren, and injuring the crops of their favourite fruit, called Figos, which are much used, both fresh and dried, Lowe l. c. 316.

b. O. amyclæa, Tenore l. c. 240; Fl. Neap. t. 236. Stature of *O. Ficus Indica*, with 4-6 stout, divergent, unequal, whitish spines on each tuft, angular at the base, orange-coloured flowers, and smaller, hardly eatable fruit. Dalmatia, South Italy, Sicily, the Canaries. Webb l. c. calls this sp. *O. Tuna*, Mill., but Lowe refers it to the Indian species *O. Dillenii*, Haw.; and the specimens in Hb. Kew from the Canaries (coll. Bourgeau) seem to confirm this view. Tenore figures, Gussone and Visiani describe their plant as having very short, nearly obsolete tufts at the base of the spines; whereas the specimens from the Canaries have a thick tuft of woolly hairs. The spines of these specimens are more angular than those of the Indian Opuntia, and somewhat transparent along their entire length. The identity, therefore, of the Indian Opuntia with the spinescent kind of South Europe and the Canaries is a matter for farther inquiry. Lowe describes his plant with yellow flowers tinged with red outside.

c. O. nana, Visiani (*O. vulgaris*, Mill. in Koch Synops. Fl. Germ. 291), is a small spinescent plant, the joints only a few inches long, not erect, but diffuse, leaning against rocks, found in Dalmatia and the warmer valleys of Tyrol and Switzerland.

The Cochineal insect in Mexico and other parts of Central America lives on several *Opuntias* nearly allied to those here described. As stated above, its introduction has been successful on Teneriffe, and there it thrives on a species closely related to the Indian one. Wight (Ill. ii. p. 50), and Royle (Ill. p. 223), describe the steps that have been taken to encourage its cultivation in India. Some Cochineal has been produced in India, and though the price of the article has diminished of late, it may yet become a matter of some importance in the drier districts of the country.

ORDER XLII. **ARALIACEÆ.**

Erect or climbing shrubs or trees, rarely herbs, with alternate simple or compound leaves. Flowers regular, umbellate, or capitate. Calyx adnate to ovary, limb short, entire toothed or lobed. Petals generally 5, very deciduous, valvate or slightly imbricate in bud. Stamens as many as petals, rarely numerous; filaments inflexed; anthers didymous, versatile. Disk epigynous. Ovary 2- or more-celled, 1 ovule in each cell. Fruit a drupe or berry, with 1 or more 1-seeded cells. Seed pendulous; testa membranous; albumen dense, fleshy; embryo minute, ovoid or oblong.—Gen. Pl. i. 931; Wight Ill. ii. 60; Royle Ill. 233.

Soft-wooded Araliaceous shrubs and small trees, often scandent or epiphytic, are not uncommon in the tropical forests of India. Within the range of this Flora they are not numerous, and it will suffice to mention a few, besides the Ivy, as representative forms.

Petals imbricate; leaves digitate, pinnate, or bipinnate, leaflets serrulate; stipules not prominent . . . . . . 1. ARALIA.
Petals valvate; leaves simple, coriaceous . . . . . 2. HEDERA.
Petals valvate; leaves digitate, coriaceous . . . . . 3. HEPTAPLEURUM.
Petals valvate; leaves tripinnate . . . . 4. HETEROPANAX.

1. ARALIA, Linn.

Herbs or shrubs, leaves digitate pinnate or bipinnate, leaflets membranous, serrulate. Flowers umbellate. Petals 5, ovate, not unguiculate, imbricate in bud. Ovary 2-5-celled. Fruit drupaceous with 2-5 crustaceous or hard pyrenes in a fleshy exocarp. Albumen not ruminated.

1. **A. Cachemirica**, Decaisne; Jacq. Voy. Bot. t. 81.—Syn. *Panax decomposita*, Wall.

A large perennial herb 6-10 ft. high; leaves bipinnate, rough, with short hairs, leaflets ovate-lanceolate, acuminate, unequal-sided. Umbels in large terminal panicles. Styles 5, connate at base. Pyrenes 5.

Abundant in the North-West Himalaya 5000-9000 ft., up the Sutlej as far as Dippi. Sikkim at 10,000-14,000 ft. Fl. June-Oct.

Pentapanax, Seemann, nearly allied to *Aralia*, has glabrous, imparipinnate leaves, with 3-7 leaflets, and entirely connate styles: 1. *P. parasiticum*, Seem. Journ. Bot. ii. 296.—Syn. *Hedera parasitica*, Don. Vern. *Kot Semal*, Kamaon, is a climbing soft-wooded shrub; rootlets on branches, leaflets 5, ovate-lanceolate, coriaceous, entire, 2-3 in. long. East Bengal, Nepal, Kamaon, (ascending to 7500 ft.) 2. *P. Leschenaultii*, Seem.—Syn. *Hedera Leschenaultii*, Wight and Arn. Prodr. 377; *H. trifoliata*, Wight Ic. t. 307; *H. fragrans*, Don. (not Roxb.), is a soft-wooded shrub, with 3, rarely 5, broad-ovate membranous leaflets 4-5 in. long, with long subulate serratures. Nilgiris, Sikkim, Nepal, Kamaon (ascending to 8500 ft.)

2. HEDERA, Linn.

Woody climbers. Leaves simple, stipules none. Flowers in paniculate umbels, polygamous. Disc tumid. Ovary 5-celled; styles short, connate. Berry subglobose, 5-celled, 5-seeded; endocarp membranous or parchment-like, closely investing the ovoid seed. Albumen ruminated.—Two species, one in Australia, the other in the temperate regions of the Old World.

1. **H. Helix**, Linn.; Wall. in Roxb. Fl. Ind., ed. Carey, ii. 515; Boissier Fl. Orient. ii. 1090; Hook. Stud. Fl. 172. *Ivy*. Vern. *Halbambar, arbambal*, Jhelam; *Karmora, mandia*, Kashmir; *Kurol*, Chenab; *Kurie, karūr*, Ravi; *Brūmbrūm, dakāri*, Bias; *Karbāru, kāniūri*, Sutlej; *Banda*, Kamaon.

A large woody climber, stem and branches attaching themselves closely and adhering firmly to wood, rocks, walls, and the bark of trees, but not penetrating into the living tissue. Branchlets, leaves, and petioles wholly glabrous, shining. Leaves leathery, dark-green above, pale-green beneath, 2-5 in. long, exceedingly variable, those of flowering branches ovate or lanceolate, with a tapering base, the others more or less triangular in outline; 3- or 5-lobed, with a rounded or cordate base, the lobes deep or shallow, often lobulate; petiole slender, varying in length, generally shorter than leaf. Flowers yellowish-green, in pedunculate globose umbels; peduncles and pedicels clothed with minute stellate scales. Berry yellow, shining, 3- or 4-seeded.

Afghanistan, and hills trans-Indus. Panjab Salt range. Himalaya, 3000-9000 ft., from the Indus to Bhutan. Kasia hills. Europe, North Africa, Western Asia, Japan. Fl. Oct. to April. The berries of the European Ivy are black, rarely yellow. Attains a large size. Mathieu, Fl. For. 138, describes a stem grown near Montpellier, 433 years old, 6 ft. 7 in. girth. Wood light-grey or yellow, soft and light. The Ivy is not a parasite; nevertheless it considerably impedes the growth of the trees to which it attaches itself.

3. **HEPTAPLEURUM,** Gærtner.

Large shrubs or trees. Leaves digitate, leaflets coriaceous, entire. Stipules prominent, connate between branch and petiole. Flowers in racemes or in paniculate umbels. Petals generally 5-6, rarely more, valvate. Stamens as many as petals. Top of fruit generally raised beyond the calyx-limb.

1. **H. venulosum,** Seemann; Journ. Bot. iii. 80.—Syn. *Paratropia venulosa,* Wight Ill. t. 118; *Hedera terebinthacea,* Wall.; *Aralia digitata,* Roxb. Fl. Ind. ii. 107. Vern. *Dain.*

A small, soft-wooded tree with straggling branches, often sending out rootlets. Leaflets 5-6, glabrous, elliptic-oblong, acuminate, unequal, the middle leaflet largest; common petiole 5-6 in. long, partial petioles ½-2 in. long. Flowers in paniculate umbels. Berry smooth, yellow, ovoid, 5-celled.

South India, Burma, Bengal, Satpura range, Kamaon, ascending to 3000 ft. Fl. Feb., March.

4. **HETEROPANAX,** Seemann.

1. **H. fragrans,** Seem. Journ. Bot. iv. 297.—Syn. *Panax fragrans,* Roxb. Fl. Ind. ii. 76.

A small soft-wooded tree 15-20 ft. high, leaves glabrous, tripinnate, 2-4 ft. long, leaflets ovate or rotundate, entire, 3-6 in. long, on short petioles. Flowers yellow, fragrant, polygamous, subsessile or shortly pedicellate, in compact subglobose, paniculate umbels, the umbels at the end of branches and branchlets generally composed of bisexual, the lateral ones of male flowers. Petals 5, valvate. Ovary 2-celled; styles 2, filiform, distinct. Fruit laterally compressed, ⅓ in. across, broader than long, 2-celled; endocarp crustaceous; albumen ruminated.

Burma, East Bengal, sub-Himalayan tract Kamaon (above 2000 ft.) to Assam. Fl. Oct.-Dec.

Fatsia papyrifera, Decaisne.—Syn. *Aralia papyrifera*, Hook. Bot. Mag. t. 4897, the Chinese Rice-paper plant; belongs to this order. It is a shrub with large white pith, from which the rice-paper is cut, and large palmately 5-lobed leaves with stellate pubescence. Indigenous in Formosa, and cultivated in China.

ORDER XLIII. CORNACEÆ.

Shrubs or trees, with leaves usually petiolate, entire, without stipules. Flowers regular, the calyx-tube adnate to the ovary; limb none or cup-shaped, truncate or 4-5-dentate, persistent, open or valvate in bud. Petals wanting, or 4-5 inserted at the base of an epigynous disc. Stamens as many as petals, rarely 2 or 4 times their number; anthers 2-celled, dehiscing longitudinally. Ovary inferior, 1-4-celled, 1, rarely 2 ovules in each cell, pendulous. Fruit generally drupaceous, with a 1-4-celled kernel, or with 2 distinct stones. Seeds pendulous, with a membranous thin coriaceous testa, copious fleshy albumen, and generally thin foliaceous cotyledons.—Gen. Pl. i. 947; Royle Ill. 215 (*Alangieæ*), 234; Wight Ill. ii. 1, 68.

Leaves alternate; petals strap-shaped; anthers long, basifixed; style elongate.	
Stamens numerous; flowers fasciculate	1. ALANGIUM.
Stamens as many as petals; flowers paniculate . . .	2. MARLEA.
Leaves generally opposite; petals short; anthers short, attached to the back; style short	3. CORNUS.

1. ALANGIUM, Lam.

Shrubs or small trees, with alternate, petiolate, oblong, entire, persistent leaves with 3 basal nerves. Flowers white, bisexual, in axillary fascicles. Calyx-tube turbinate, somewhat prolonged beyond the ovary, truncate or 5-10-dentate. Petals 5-10, strap-shaped, valvate, afterwards reflexed. Stamens as many as petals, or 2-4 times their number; filaments short, hairy; anthers linear; cells adnate to the connective, and dehiscent laterally. Ovary 1-celled, with 1 ovule; style filiform. Fruit a berry, crowned with the persistent limb of calyx. Seeds oblong, with ruminate albumen, a superior cylindrical radicle, and foliaceous, veined, cordate-ovate cotyledons.

1. **A. Lamarckii**, Thwaites, Enum. Plant. Zeyl. 133; Bedd. Fl. Sylv. t. 215.—Syn. *A. hexapetalum*, Roxb. Fl. Ind. ii. 502; W. & A. Prodr. 326; Wight Ill. t. 96. *A. decapetalum*, Wight Ic. t. 194; W. & A. Prodr. 325. *A. tomentosa*, Lam. Sans. *Ankola, nikochaka.* Vern. *Akol, akola, akhōra, akaul, ghowl, koeli* (*Alangi*, Tamil, whence generic name).

A shrub or tree, branchlets often spinescent. Leaves membranous, 3-6 in. long, on petiole ¼ in., exceedingly variable in shape, from linear-oblong to elliptic, obtuse acute or long-acuminate, pubescent or tomentose when young, glabrous or pubescent below when full-grown, main lateral nerves 5-8 on either side of midrib, joined by prominent transverse and intramarginal veins. Flowers white, fragrant, on short bracteate pedicels, solitary or fasciculate; pedicels and calyx hairy. Calyx 6-10-dentate; petals 6-10; stamens twice as many; filaments with long stiff hairs at the base. Fruit ¾ in. long, tomentose, filled with red pulp.

I follow Thwaites in uniting the 3 species of Lamarck, Encycl. Meth. Botanique i. 174, and adopting his new specific name. The appearance of the plant is exceedingly variable, and the different forms, tomentose or glabrous, with broad acuminate, and with narrow, almost linear leaves, with or without spines, merit farther study.

Common in places in South and Central India, Bengal, Oudh, and North-West India. In the sub-Himalayan tract, only as far west as the Ganges. Ceylon and China. Never quite leafless; the foliage is renewed in April-May. Fl. usually Feb.-April; fr. May-Aug.

In North and Central India attains 30-40 ft. under favourable conditions, but generally remains much smaller. Trunk short, erect, to 2½ ft. girth. Bark ½ in. thick, grey with some white specks, smooth, with irregular undulations. Wood light- or yellowish-brown, often dark-coloured in the centre, fine- even- close- and smooth-grained, tough and strong, weight 49 lb. per cub. ft. Value of P. 875, easily worked, with a beautiful glossy surface, well suited for ornamental work. Used for pestles to crush oil-seeds, wooden cattle-bells, and various other purposes. Yields excellent fuel. Coppices well. Fruit mucilaginous, sweet, somewhat astringent and acid, is eaten. Root aromatic, used in native medicine.

2. MARLEA, Roxb.

Trees or shrubs, with alternate, entire or angularly-lobed leaves. Flowers bisexual, in axillary cymes. Calyx-limb minutely toothed. Petals 6-10, linear, valvate in bud. Stamens as many as petals; filaments short, adhering at the base to petals; anthers long and linear. Ovary adhering to calyx above the middle, 2-celled, with 1 pendulous ovule in each cell. Style filiform, with a 4-lobed stigma. Fruit a drupe, often 1-celled, 1-seeded.

1. **M. begoniæfolia**, Roxb. Cor. Pl. t. 283; Fl. Ind. ii. 261; Bot. Reg., 1838, t. 61. Vern. *Garkum, budhal, tūmbri*, N.W.P.; *Bodara*, Bias; *Padlu*, Ravi; *Siālu*, Chenab; *Prot*, Kashmir; *Tilpattra, chitpattra, kurkni*, Jhelam.

A small tree, glabrous, youngest parts with rust-coloured pubescence. Leaves 3-10 in. long, varying from ovate acuminate, to broad obliquely cordate, often broadly and angularly lobed, petioles ¾-1¼ in. long; basal nerves 3 or 5, main lateral nerves 2 or 3 on either side of midrib, petioles and nerves often reddish. Cymes a little longer than petioles, loosely 4-20-flowered. Flowers conspicuous, with white petals and yellow anthers. Stamens and style hairy, stigma 4-lobed. Drupe ovoid, ¼-½ in. long, crowned with remains of calyx, with scanty, soft, dark-coloured pulp, and a hard stone. Radicle short, superior. *M. affinis*, $\mathrm{D^{ne}}$. in Jacquem. Voy. Bot. t. 83, from Kashmir, is described with hairy style and 2-lobed stigma. The North-West Himalaya specimens which I have examined have hairy styles, and a 4-lobed stigma.

Siwalik tract and outer Himalayan ranges, ascending to 6000 ft., from near the Indus, to Bhutan, in Sikkim to 9000 ft. Kasia hills, Silhet, and Chittagong. Dense shady forests, sparse in the North-West Himalaya. Fl. March-May; fr. July-Oct. A handsome tree, never growing to any great height. Bark smooth, cinereous. Foliage resembles that of some Maples. In Silhet it is called *Marlea* or *Marliza,* and the wood is employed for building. The leaves are collected for sheep-fodder in the North-West Himalaya.

3. CORNUS, Linn.

Trees, shrubs, rarely herbs, with opposite, rarely alternate leaves. Flowers bisexual, white or yellow, in heads or dichotomous cymes. Calyx-teeth 4, minute. Petals 4, oblong or ovate, valvate in bud. Stamens 4, alternating with petals, filaments subulate or filiform, anthers oblong. Ovary 2-celled, rarely 3-celled, one ovule in each cell. Fruit drupaceous, with a 2-celled, 2-seeded, hard, crustaceous or osseous putamen. Seeds oblong, compressed; testa membranous, albumen fleshy, cotyledons foliaceous, radicle sessile.

Flowers in compound cymes.	
Leaves broad-ovate, acuminate, penniveined, main lateral nerves 5-8 pair	1. *C. macrophylla.*
Leaves oblong, penniveined, main lateral nerves 3-5 pair .	2. *C. oblonga.*
Leaves elliptic or ovate-elliptic, 2-3 pair of lateral nerves, sub-basal	3. *C. sanguinea.*
Flowers in globose, bracteate heads, drupes confluent . .	4. *C. capitata.*

1. **C. macrophylla,** Wall.—**Tab. XXXII.**—Roxb. Fl. Ind., ed. Carey, i. 433. Vern. *Kasīr, kachīr, haleo, allian, harrū, haddū, nang, kandara,* Ravi to Jhelam; *Kaksh, kachūr, kochan,* Sutl. and Bias; *Kāgsha, rūchia,* N.W.P.

A middle-sized tree, with opposite broad-ovate, acuminate leaves, pale glaucous beneath, 4-6 in. long, base rounded, sometimes slightly cordate, not narrowed into petiole; when young with short distant adpressed hairs, generally attached in the middle; main lateral nerves arcuate, 5-8 on either side of midrib, joined by prominent transverse and intramarginal veins; petiole ½-1 in. long. Flowers in ample, terminal compound cymes, 2-4 in. across, on peduncles, bearing 2 or 3 pair of opposite, or nearly opposite branches, dividing dichotomously; the flowers at the ends of branchlets in short unilateral racemes. Cyme longer than the naked portion of peduncle. Flowers before opening ⅛ in. long, twice or three times the length of pedicels. Calyx, outside of petals, and pedicels strigose with white adpressed hairs; disc thick. Drupe globose, less than ¼ in. long, crowned with the remains of calyx and disc.

Frequent in many parts of the Himalaya, from near the Indus to Nepal, between 3000 and 8000 ft. Fl. May, June. Generally scattered, though sometimes in considerable numbers, in shady mixed forests, a handsome tree 40-50 ft. high, and attaining a girth of 5-6, at times 8 ft. Crown rounded, close, shady. Bark brownish, smooth, with longitudinal wrinkles. Wood light-reddish, compact, and even-grained, noted as yielding excellent charcoal for gunpowder, 8-9 rings per in. rad. The fruit is eaten, and the leaves furnish fodder for goats.

2. **C. oblonga**, Wall.; Roxb. Fl. Ind., ed. Carey, i. 432.—Vern. *Kasmol*, N.W.P.; *Bakār*, *ban-bākūr*, Pb.

A middle-sized tree, with opposite, oblong, acuminate leaves, base acute narrowed into petiole, glaucous beneath, 2-6 in. long, when young with short adpressed hairs, lateral nerves arcuate, 3-5 on either side of midrib, petiole ¼-¾ in. long. Ample terminal compound cymes on short peduncles. Flowers white or purplish white, odorous, full-sized buds less than ¼ in. long, on short pedicels. Outside of petals glabrous; calyx and pedicels slightly strigose; disc thick. Drupe ovoid, crowned with the remains of calyx, somewhat more than ¼ in. long.

Siwalik tract and outer Himalaya, from near the Indus to Bhutan, between 3000 and 6000 ft. Fl. Sept.-Oct.; fr. Jan.-April. Attains 40 ft., and a girth of 4-5 ft. Bark reddish brown, very rugose, especially longitudinally. Wood white, shining, with numerous red and brown medullary rays, fine-grained and hard.

3. **C. sanguinea**, Linn.; Hook. Stud. Fl. 172.—*Dogwood.*

A shrub or small tree, pubescent, with membranous, opposite, elliptic or ovate-elliptic leaves, acute or short-acuminate, main lateral nerves 4 pair, arcuate, the lower 2 or 3 pair proceeding from the base or the lowest third of midrib, all, or the upper 3 pair meeting at the apex of the leaf. Leaves 1-3 in., petiole ½ in. long. Cymes terminal, dense-flowered, 2 in. across, peduncle longer than cyme. Flowers cream-white, buds before opening ¼ in. long. Berry subglobose, less than ¼ in. long, black when ripe.

Found by Dr Stewart, once only, in a close forest, with a northerly aspect, at 7000 ft., on the high mountain-range south of the Kashmir valley, a few small trees in fruit, 18-20 ft. high, ramous from near the ground, with straight branches into a lax roundish crown, and thin grey or brownish bark, covered with a smooth, silvery pellicle, which peels off. A common shrub in Europe and Siberia. I am doubtful whether Dr Stewart's specimen should be referred to *C. sanguinea* or to *C. australis*, C. A. Meyer; Boissier Fl. Orient. ii. 1092, of Asia Minor, the Caucasus, and North Persia; the difference between the two species is very slight, the hairs on the under side of the leaves of *C. sanguinea* ought to be simple, and somewhat curled, those of *australis* should be 2-armed and stiff. *C. sanguinea* in Europe is a slow-growing shrub, spreading readily by seeds and root-suckers, and standing a good deal of shade. The wood is hard and close-grained. The pericarp of the fruit contains oil. The young shoots are red in spring, the leaves turn red in autumn, hence the name.

4. **C. capitata**, Wall. Fl. Ind., ed. Carey, i. 434; Pl. As. rar. t. 214.—Syn. *Benthamia fragifera*, Lindley; Wight Ill. t. 122. Vern. *Bamora*, *bamaur*, N.W.P.; *Tharmal*, *tharbal*, *tharwar*, *thesi*, Pb.

A small tree, young branches and leaves scabrous with short stiff adpressed hairs. Leaves coriaceous, pale below, opposite, generally approximate at ends of branchlets, 2-3 in. long, elliptic-oblong, penniveined, with 4 pair of arcuate main lateral nerves; petioles ½ in. long, with a broad, almost sheathing base. Flowers closely packed, in globular terminal heads with a conspicuous involucre of 4 yellow, petal-like bracts, peduncles 1-2 in. long. Drupes united in a yellowish strawberry-like fleshy head, 1-2 in. diam., each drupe with a hard, 1-seeded stone.

Himalaya 3500-8000 ft., from the Bias to Bhutan, Kasia hills. Fl. April-Oct. Wood close-grained, very hard. Fruit sweetish, mingled with a little bitter, eaten and made into preserves.

A remarkable genus of this order is *Aucuba*, Thunb., with evergreen, glabrous, shining serrate leaves, and dioicous flowers. *A. japonica*, Thunb., is now one of the most common hardy evergreen shrubs in England and western Europe. *A. himalaica*, Hf. & Th.; Hook. f. Ill. Himal. Pl. t. 12, from the outer ranges of Sikkim, is closely allied to it.

ORDER XLIV. CAPRIFOLIACEÆ.

Shrubs or small trees, rarely herbs. Leaves opposite, simple entire ternately cut or pinnate, usually exstipulate. Calyx-tube adnate to ovary, limb 3-5-toothed or lobed. Corolla gamopetalous, regular or irregular, lobes 5, imbricate in bud. Stamens 4-10, inserted on the corolla-tube, equal or unequal, anthers versatile. Ovary 1-6-celled, ovules solitary or numerous. Fruit a berry or drupe, rarely capsular, 1- or many-seeded. Albumen copious, fleshy, embryo generally minute.—Gen. Pl. ii. 1; Royle Ill. 235; Wight Ill. ii. 69.

Corolla tubular or campanulate; ovary cells with 1 or many ovules; style filiform.	
Stamens 5; calyx 5-dentate; ovary 2-3-celled . . .	1. LONICERA.
Stamens 5; calyx 5-lobed, lobes linear; ovary 5-celled .	2. LEYCESTERIA.
Stamens 4; calyx 5-lobed, lobes linear, elongate; ovary 3-celled. Fruit 1-seeded	3. ABELIA.
Corolla rotate or short-tubular. One ovule in each cell; style short, or stigma sessile.	
Leaves simple	4. VIBURNUM.
Leaves pinnate	5. SAMBUCUS.

1. LONICERA, Linn.

Erect, prostrate or climbing shrubs. Leaves opposite, entire. Flowers in peduncled cymes or heads, often connate in pairs by the ovaries, and subtended by connate bracteoles. Calyx-tube ovoid or subglobose; teeth 5, often unequal. Corolla tubular, funnel or bell-shaped, limb oblique or 2-lipped, 5-lobed. Stamens 5. Disc tumid. Ovary 2-3-celled, style filiform, stigma capitate; ovules many in the inner angle of each cell. Berry fleshy, 2-3-celled, cells few-seeded. Seeds ovoid or oblong, testa crustaceous.

To this genus belongs the *Woodbine* or *Honeysuckle* of Europe, *L. Periclymenum*, Linn.; Hook. Stud. Fl. 175. From India 28 species, nearly all Himalayan, are enumerated in Hooker and Thomson's Præcursores ad Floram Indicam, Journ. Linn. Soc. ii. 165. Of these it must suffice here to mention 7 species which are characteristic of the forest vegetation in the outer and middle ranges of the N.W. Himalaya.

Corolla 5-lobed, not bilabiate; bracteoles large, generally connate, and enclosing the ovaries.	
A large shrub, unarmed; leaves lanceolate	1. *L. angustifolia.*

A small bush, spinescent; corolla-tube long slender . . 2. *L. spinosa.*
A small bush, corolla-tube broad-campanulate . . 3. *L. Myrtillus.*
Corolla bilabiate, bracteoles large, more or less connate.
Pubescent; leaves petiolate, flowers nearly sessile . . 4. *L. quinquelocularis.*
Glandular hairy; leaves nearly sessile, white beneath, flowers pedunculate . . . . 5. *L. hypoleuca.*
Corolla bilabiate, bracteoles small, free.
Glabrous; main lateral nerves 8-12 pair . . . 6. *L. orientalis.*
Glandular hairy; main lateral nerves 6-8 pair . . 7. *L. alpigena.*

1. **L. angustifolia**, Wall.—Vern. *Gēang*, Jaonsar; *Pūlru*, Sutlej.

A shrub 6-12 ft. high, with slender branches; bark grey, peeling off in long fibrous shreds. Glabrous, or youngest parts pilose; leaves lanceolate or oblong-lanceolate, pale beneath. Flowers in pairs, on slender axillary peduncles, ½-1 in. long; bracteoles connate, cup-shaped, enclosing the ovaries. Bracts 2, linear or foliaceous. Corolla ½ in. long or less, regular, white or pale rose coloured, scented. Berry red, the size of a pea, with 1-6 seeds.

Not uncommon in the Himalaya, from near the Indus to Sikkim. In the North-West Himalaya at 6000-10,000 ft. Dippi, and other forests in Kunawar, Deoban range, Jaonsar Bawar. Fl. May, June; fruit sweet, eaten. Hardy in England.

2. **L. spinosa**, Jacquemont.—Syn. *Xylosteum spinosum*, Decaisne, in Jacq. Voy. Bot. t. 86. *L. linearis*, Hb. Royle.

A small rigid shrub, wholly glabrous, with stiff divaricate, spinescent branchlets and small, linear-oblong coriaceous leaves. Flowers ¾ in. long, on short peduncles, tube long, slender; limb broad, spreading; anthers and style exserted.

Inner arid Himalaya and Tibet, 11,000-15,000 ft. Fl. July.

3. **L. Myrtillus**, Hf. & Th. l. c. 168.

A small shrub with prostrate branches. Leaves ⅓-½ in. long, elliptic-oblong or obovate-oblong, glaucous beneath. Flowers white subsessile, corolla short, broad-campanulate, ⅓ in. long; anthers and styles included.

Himalaya from the Indus to Sikkim, 9000-12,000 ft. Fl. June-Sept. Nearly allied are *L. parvifolia*, Edgew., and *L. purpurascens*, H. f. & Th. (*Xylosteum purp.*, Jacq. Voy. Bot. t. 87).

4. **L. quinquelocularis**, Hardwicke; Roxb. Fl. Ind. i. 537.—Syn. *L. diversifolia*, Wall. Roxb. Fl. Ind., ed. Carey, ii. 169; Bot. Reg. xxx. 1844, t. 33. *Himalayan Honeysuckle.* Vern. *Jarlangei*, *adei*, trans-Indus; *Phūt*, Jhelam; *Tita bateri*, *pākhur*, Kashmir; *Bakhru*, Chenab; *Khūm*, *sāi*, Ravi; *Dendru*, Bias; *Kliūnti*, *zbang*, *razbam*, *bijgai*, Sutlej; *Bet kukri*, *bhat kūkra*, *cheraya*, *kurmali*, Kamaon.

A large erect shrub, pubescent or soft-tomentose. Leaves 1-2 in. long, ovate or elliptic, acute, on short petioles. Flowers nearly sessile, in axillary clusters of 2-4; ovaries free. Bracts linear, ciliate; bracteoles broad-ovate, ciliate, obtuse, connate at the base. Calyx-limb cup-shaped, 5-cleft, hairy. Corolla yellow, ¾ in. long before opening; limb 2-lipped, upper lip broad, 4-dentate, lower lip linear. Berry sessile, ovoid, ¼ in. long, crowned with remains of calyx.

Common North-West Himalaya 2500 - 9000 ft., also Suliman range and Safedkoh trans-Indus. Bhutan. Fl. June, July. Bark grey, peeling off in long shreds. Cattle feed on its leaves and branches. Hardy in England. Closely allied to *L. Xylosteum*, Linn., of Europe and Siberia, which, however, has smaller flowers in pairs on short axillary peduncles.

5. **L. hypoleuca**, Decaisne, Jacq. Voy. Bot. t. 89.—Vern, *Kharmo, kodi*, Chenab; *Zhīko, rapesho,* Sutlej.

A small shrub, with glandular hairs, particularly on bracteoles and corolla; leaves nearly sessile, from cordate base oblong or broad-ovate, obtuse, pale-grey beneath; flowers twin, on short peduncles; bracts linear-oblong; bracteoles connate, cup-shaped, enclosing the connate ovaries.

Arid tracts of the inner Himalaya on the upper Jhelam, Chenab, Sutlej, and in Garhwal, at 8000-10,000 ft. Fl. June.

6. **L. orientalis**, Lamarck; Hf. & Th. l. c. 170.—Syn. *L. Govaniana*, Wall.

A slender glabrous shrub; leaves membranous, petiolate, ovate or ovate-lanceolate, 2-4 in. long, main lateral nerves 8-12 on each side of midrib, anastomosing by prominent reticulate veins. Flowers twin; ovaries connate, supported by minute rounded bracteoles and subulate arcuate bracts. Calyx-lobes subulate. Corolla ⅓ in. long before opening, deeply bilabiate. The 2 ovaries connate into a pyriform black berry.

North-West Himalaya from Kashmir to Kamaon, 6000-10,000 ft. Also in Iberia and on the Caucasus. Fl. June. Hardy in England. Closely allied is *L. heterophylla*, D^{ne}. in Jacq. Voy. Bot. t. 88.

7. **L. alpigena**, Linn.; H. f. & Th. l. c. 171.—Syn. *L. Webbiana*, Wall.; *oxyphylla*, Edgew.

With glandular hairs; leaves petiolate, ovate-lanceolate, long acuminate, with 6-8 pairs of main lateral nerves, reticulate veins not prominent. Peduncles longer than of L. orientalis. Corolla with unequal very gibbous base.

North-West Himalaya, Kashmir to Kamaon, 8000-10,000 ft. Also in the Alps of Europe. Fl. June. Hardy in England.

2. LEYCESTERIA, Wall.

An erect shrub, with hollow, herbaceous stems; the flowers sessile, in bracteate whorls. Calyx-limb 5-lobed, lobes linear. Corolla funnel-shaped; stamens 5. Ovary 5-celled, with numerous pendulous ovules. Fruit a fleshy, 5-celled, many-seeded berry.

1. **L. formosa**, Wall.; Roxb. Fl. Ind., ed. Carey, ii. 182; Wight Ill. t. 121, D.—Vern. *Nalkarru, saunjla*, Kamaon.

Leaves ovate or ovate-lanceolate, long-acuminate, the petioles connate with their broad base. Bracts foliaceous, more or less purple, sessile, ovate-lanceolate, commonly 6 under each whorl, the two outer ones 1-1½ in. long, generally connate at the base. Corolla white, with a tinge of purple. Berry dark-purple, approaching to black, as large as a small gooseberry, crowned with the persistent calyx, and covered with short glandular hairs.

Not uncommon in shady forests of the Himalaya between 5000 and 10,000 ft. Sutlej to Sikkim. Kasia hills. Hardy in England.

3. **ABELIA,** Brown.

Small shrubs, with bracteate flowers. Calyx-tube angular, limb 5-cleft, lobes foliaceous. Corolla funnel-shaped. Stamens 4. Ovary 3-celled, 2 cells with several abortive ovules, the third with one perfect ovule. Berry coriaceous, 1-seeded.

1. **A. triflora,** R. Brown in Wall. Pl. As. rar. t. 15.—Vern. *Adei, pakhtāwar,* trans-Indus; *Cheta būta,* Jhelam; *Ban bakhuru, salanker,* Chenab; *Dalūng, kūt, sāi,* Ravi; *Zbang, matzbang, peni,* Sutlej; *Munri, gogatti,* Kamaon.

A shrub, with ovate-lanceolate leaves, pale beneath, hairy along edges and midrib; petioles united by their broad bases. Flowers in dense terminal bracteate heads; bracts foliaceous, the upper sessile. Flowers 3 together on short peduncles, the middle sessile, the two lateral short-pedicellate, all supported at the base of the calyx by linear-lanceolate bractlets. Calyx hairy, 5-ribbed; lobes linear, ciliate, with a prominent midrib, ½-1 in. long at the time the fruit ripens. Corolla white, tinged with pink, scented.

Abundant in the North-West Himalaya between 4000 and 10,000 ft.; also on the Safedkoh and Suliman range. Fl. June-Aug. Is browsed by goats. Hardy in England.

4. **VIBURNUM,** Linn.

Shrubs or trees with simple leaves. Flowers white or pink, in terminal or axillary corymbs or panicles. Calyx-limb 5-toothed; corolla 5-lobed. Stamens 5. Ovary 1-3-celled; style conical, trifid, or stigmas 3, sessile; one pendulous ovule in each cell. Drupe dry or fleshy; endocarp crustaceous, 1-seeded, 1-celled, or spuriously 2- or 3-celled by the endocarp projecting into the cavity.

A large genus with some species widely spread in Europe, wild, and cultivated as ornamental shrubs. *V. Opulus,* the Guelder Rose, with large outer sterile flowers, a native of Europe, Siberia, and North America; and *V. Tinus* of the western Mediterranean region, remarkable because its showy flowers stand the cold of average winters in England, and are destroyed only in very severe seasons. Of the sixteen Indian species described by Hooker and Thomson in the Journ. Linn. Soc. ii. 174, it will suffice to enumerate seven, the most common in the North-West Himalaya.

Leaves membranous, deciduous; drupe 1-celled.
  Corolla short-campanulate; leaves with dense grey tomentum beneath . . . . 1. *V. cotinifolium.*
  Corolla rotate; leaves glabrous or pubescent . . . . 2. *V. stellulatum.*

Leaves membranous, deciduous; drupe spuriously 3-celled.
  Flowers with the leaves, in slender drooping panicles . 3. *V. erubescens.*
  Flowers before the leaves in sessile corymbs.
    Main lateral nerves close, 8-10 pair; drupe ⅓ in. long . 4. *V. nervosum.*
    Main lateral nerves distant, 7-9 pair; drupe ¾ in. long . . . . 5. *V. fœtens.*
Leaves coriaceous, evergreen; drupe 1-celled.
  Corolla tubular, limb erect; corymbs without bracts . 6. *V. coriaceum.*
  Corolla rotate; corymbs with ciliate bracts . . . 7. *V. punctatum.*

1. **V. cotinifolium**, Don.; Bot. Reg. t. 1650; Wight Ill. t. 121 A.—Syn. *V. polycarpum*, Wall. Vern. *Mar ghwalawa*, trans-Indus; *Rich ūklu*, *bankūnch*, Jhelam; *Richabi*, *kūlmīch*, *gūch*, Kashmir; *Bathor*, *pāpat kalam*, *khīmor*, *rājal*, *tūmma*, Chenab; *Kātonda*, Ravi; *Jāwa*, *khatip*, *tūstūs*, *sūssū*, Sutlej; *Gwia*, Kamaon.*

A large shrub, inflorescence and under side of leaves clothed with dense grey stellate tomentum. Leaves 3-5 in. long, ovate or rotundate, entire or crenulate, 2-5 in. long, glabrous or pubescent above, on short thick petioles; main lateral nerves oblique, 5-6 pair, dividing into prominent branches half-way between midrib and edge of leaf. Flowers numerous, in sessile or short-pedunculate corymbs. Calyx-lobes short; corolla turbinate, white tinged with pink. Drupe oblong, ⅓ in. long, compressed, with 2 furrows on each face.

Abundant between 4000 and 11,000 feet in the N.W. Himalaya, also on the Suliman range. Fl. June-July. The ripe fruit is sweetish, and is eaten. Hardy in England. Nearly allied to *V. Lantana*, Linn., of Middle and South Europe and the Caucasus, with white, rotate corolla.

2. **V. stellulatum**, Wall.; Pl. As. rar. t. 169.—Syn. *V. Mullaha*, Ham. Vern. *Jal bāgū*, Jhelam; *Amliācha*, *phulsel*, Kashmir; *Tit maliya*, Kamaon.

Branchlets, petioles, and inflorescence with stellate pubescence. Leaves glabrous above, more or less pubescent beneath, ovate or ovate-lanceolate, long-acuminate, dentate, with large, sharp teeth; 3-5 in. long; petioles ½-1 in. long; main lateral nerves 5-6 pair, oblique, undivided save near the margin, the lowest pair only with strong branches on the outside. Flowers small, in large, compound, nearly umbellate corymbs; corolla white, rotate, pubescent outside. Drupe ovate-oblong, compressed, shining, ¼-½ in. long.

Common in the N.W. Himalaya, between 6000 and 10,000 ft. Fl. July-Aug.; fruit acid, eaten. *V. involucratum*, Wall., probably does not differ from this species.

3. **V. erubescens**, Wall.; Pl. As. rar. t. 134.—Syn. *V. Wightianum*, Wall.; W. & A. Prodr. 388; Wight Ic. 1024.

A shrub or small tree, with slender cinereous branches, nearly glabrous or pubescent. Leaves broad-ovate or oblong, with cordate or rounded base, acuminate, serrate, 2-3 in. long; petioles ½-¾ in.; main lateral nerves

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* The vern. names of the sp. of *Viburnum* demand further inquiry.

5-6 pair, arcuate, the lowest pair from the base. Flowers ½ in. long, white, or yellowish white, or pale rose-coloured, in slender drooping pedunculate panicles. Calyx-lobes ovate, obtuse. Corolla tubular, wider above, limb spreading. Stamens 5, inserted at the same height in the mouth of the corolla. Fruit red, ovoid, ¼ in. long, the endocarp projecting into the cavity with two wings so as to give the appearance of 3 cells. Seed flat, concave, with the two edges bent inward.

Himalaya from Kamaon to Bhutan 5000-11,000 ft. Nilgiris and Ceylon above 4000 ft. Fl. March-May.

4. **V. nervosum**, Don.—Syn. *V. grandiflorum*, Wall. Vern. *Ambre, amrola, āri*, Ravi; *Rīs, dāb*, Bias.

A shrub, with stiff, stout, dark grey or brownish branchlets. Leaves generally approximate at the ends, elliptic or oblong, acuminate, serrulate, glabrous above, pubescent beneath, 3-4 in. long; petioles ¾ in.; main lateral nerves closely parallel, 8-10 pair. Flowers white or rose-coloured, odorous, ¾ in. long, appearing before the leaves in terminal, short, sessile, dense corymbs; peduncles, pedicels, and bracts with long white hairs. Calyx-lobes short, obtuse. Corolla funnel-shaped, with a spreading limb. Stamens unequal, 3 inserted below, 2 above, in the corolla-tube. Drupe flat, ovate, ⅓ in. long; endocarp projecting into the cavity, and seed concave as in *V. erubescens*.

Himalaya from the Jumna to Sikkim. Jaunsar Bawar forests 7000-9000 ft.; ascends to 12,000 ft. Fl. May.

5. **V. fœtens**, Decaisne; Jacq. Voy. Bot. t. 84. Vern. *Gūch, ūklu, kūnch*, Jhelam; *Kūlmīch, gūch, kwillim, kulāra, jamāra*, Kashmir; *Tilhanj, pūlmu, tilāts, tūin*, Chenab; *Talhang, tandei, tūndhe, tunāni zenāni*, Ravi.

Closely allied to *V. nervosum*, differs only by larger, glabrous leaves, main lateral nerves more distant, 7-9 pair; corymbs lax; and drupes ¾ in. long. The stamens are biseriate, as in *V. nervosum*, 2 inserted above, 3 below, and the seed is concave. The flowers are sweet-scented, but the branches, when bruised, emit a bad smell.

Common in the Panjab Himalaya at from 5000-11,000 ft. Fl. May-June. The fruit is sweetish, and is eaten.

6. **V. coriaceum**, Blume.—Syn. *V. capitellatum*, W. & A. Prodr. 388; *V. cylindricum*, Ham. Vern. *Kala Titmaliya*, Kamaon.

A shrub or small tree, glabrous, only youngest branchlets, petioles, peduncles, and pedicels glandular-pubescent. Leaves coriaceous, entire or sinuate, oblong, long-acuminate, 3-6 in. long, with 3-4 pair main lateral nerves. Flowers ¼ in. long, numerous, in pedunculate, umbellate corymbs, without bracts. Corolla short, tubular, somewhat wider at the mouth; limb erect, with 5 obtuse, short lobes. Stamens exserted. Drupe 1-celled; endocarp not projecting into the cavity.

Himalaya 4000-7000 ft. from Sutlej to Sikkim. Kasia, Ceylon, Nilgiris. Fl. Nov.-May.

7. **V. punctatum**, Ham.—Syn. *V. acuminatum*, Wall.; Wight Ic. t. 1021.

A shrub with stout branches, wholly glabrous. Leaves coriaceous, elliptic, acuminate, 3-5 in. long; margins revolute, beneath with numerous fine round dots; main lateral nerves 4-6 pair. Flowers small, in large, terminal corymbs, with angular branches, and broad, ciliate bracts. Corolla rotate. Drupe ⅓ in. long, 1-celled; endocarp undulate on a cross-section, not projecting into cavity.

Outer Himalaya in Kamaon and Nepal, ascending to 5000 ft. Nilgiris, pulneys, Anamallays, Western Ghats, Canara. Fl. Jan.-March.

5. SAMBUCUS, Linn.

Large herbs, shrubs or trees, with large pith. Leaves pinnate. Flowers small, in umbellate corymbs or panicles. Calyx-limb 3-5-toothed. Corolla rotate or campanulate, 3-5-cleft. Stamens 5. Ovary 3-5-celled; style short, 3-5-partite, or stigmas 3-5, sessile; one pendulous ovule in each cell. Drupe with 3-5 cartilaginous cells. Seed compressed, embryo long.

1. **S. Ebulus**, Linn.; Hook. Stud. Fl. 174. *Dwarf Elder.*—Vern. *Richh kas, mushkiāra, ganhūla*, Jhelam; *Gāndal, gwāndish, siske, tāsar*, Chenab.

Large herbaceous stems 3-6 ft. high, from a perennial root-stock, glabrous; leaflets 3-5 pair, shortly stalked, oblong-lanceolate, sharply and closely serrate. Stipules foliaceous, often pinnate. Flowers in a large, sessile or pedunculate, compact corymbose cyme 4-6 in. across. Corolla-limb concave.

Upper Chenab and Jhelam between 4000 and 11,000 ft. Europe, North Africa, West Asia. Fl. April-July. Leaves fetid when bruised.

ORDER XLV. RUBIACEÆ.

Trees, shrubs, or herbs, rarely climbers, with opposite or whorled leaves, and inter- or intra-petiolar stipules, either free or connate with the petioles, or forming a short sheath or ring round the stem within the petioles. Calyx-tube adnate to the ovary, the limb entire or with as many teeth lobes or divisions as lobes of the corolla, rarely more or fewer. Corolla gamopetalous, inserted round the epigynous disc; lobes 4, 5, or sometimes more, rarely only 3, either imbricate (often contorted) or valvate in the bud. Stamens as many as lobes of the corolla, alternating with them, and inserted in the tube; anthers versatile, with parallel cells opening longitudinally. Ovary inferior, 2- or more-celled, rarely 1-celled. Fruit various. Seeds with a fleshy or horny albumen, rarely with little or no albumen.—Gen. Pl. ii. 7; Royle Ill. 237; Wight Ill. ii. 72 (*Cinchonaceæ*).

Seeds numerous; flowers numerous, in globose heads.

Glabrous; corolla imbricate; fruit a fleshy syncarpium . 1. ANTHOCEPHALUS.

Pubescent; corolla valvate; capsules dry, distinct, in globose heads.
Leaves oval or obovate; calyx truncate; stigma with concave base . . . . 2. STEPHEGYNE.
Leaves cordate; calyx 5-lobed; stigma clavate or capitate . . . . 3. ADINA.
Seeds numerous, in 2-valved capsules; flowers numerous, in spikes or panicles.
Corolla valvate; flowers in 3-chotomous panicles; corolla-lobes fringed; capsule dehiscing septicidally from below; leaves evergreen . . . . . . 4. CINCHONA.
Corolla valvate; flowers in bracteate spikes; capsule dehiscing loculicidally; leaves deciduous . . . . 5. HYMENODICTYON.
Corolla imbricate; flowers in 3-chotomous panicles . . 6. WENDLANDIA.
Seeds numerous, in indehiscent berries; flowers few; corolla contorted.
Flowers large or middle-sized, solitary, rarely fasciculate.
Ovary 1-celled; placentæ parietal; flowers 5-9-merous 7. GARDENIA.
Ovary 2-celled; placentæ on dissepiment; flowers 5-merous 8. RANDIA.
Flowers small, in sessile opposite axillary fascicles . 9. HYPTIANTHERA.
Seeds 2, each enclosed in a chartaceous endocarp.
Flowers in trichotomous panicles.
Leaves coriaceous; stipules interpetiolar; style short exserted, 2-fid . . . . 10. IXORA.
Leaves membranous; stip. sheathing; style long exserted, undivided . . . . 11. PAVETTA.
Flowers in axillary fascicles . . . . 12. COFFEA.
Seeds solitary, fruit a fleshy syncarpium with numerous 1-seeded pyrenes, several pyrenes often connate . . 13. MORINDA.
Seeds 5; ovary 5-celled; flowers in trichotomous panicles . 14. HAMILTONIA.

1. ANTHOCEPHALUS, A. Richard.

Large trees, glabrous, with opposite, petiolate coriaceous leaves, and large interpetiolar caducous stipules. Flowers in globose, compact, terminal heads, without bracts and bracteoles. Calyx-tubes more or less connate, the limb cleft into 5 spathulate or oblong lobes. Corolla funnel-shaped, mouth glabrous, the lobes imbricate. Stamens 5, inserted in the mouth of the corolla-tube, on short flattened filaments, the anthers ovate-oblong, apiculate. Ovary 2-celled below, 4-celled above, the placentæ bifid above; style filiform, exserted, stigma fusiform; ovules numerous in each cell. Fruit a fleshy syncarpium, with numerous pyrenes, 4-celled above, 2-celled below, each with few seeds. Seeds minute, with a fleshy albumen; embryo clavate, with short cotyledons and an obtuse radicle.

1. **A. Cadamba**, Benth. & Hook.—Syn. *Nauclea Cadamba*, Roxb. Fl. Ind. i. 512; Bedd. Fl. Sylv. t. 35. Sans. *Kadamba*, *nīpa*. Vern. *Kaddam*, *karam*.

A large tree, with horizontal branches. Leaves ovate-oblong, glabrous and shining above, pubescent beneath, acuminate, 5-9 in. long, with 10-12 pairs of prominent main lateral nerves. Flower-heads solitary, pedunculate, 1-2 in. diam., orange-coloured, scented, with large, white, fusiform projecting stigmas. Fruit yellow, size of a small orange.

Cultivated in Bengal and North India, as far west as Saharanpur. Wild in

Ceylon and North Canara, and perhaps elsewhere along the western coast. Believed also to be indigenous in Assam. Fl. May-July. Trunk tall, erect, regularly shaped. Wood light yellow; the cub. ft. weighs 36-47 lb.; the mean value of P. was found 616 (Puckle), and 618 (Cunningham). The flowers offered in Hindu shrines; the fruit is eaten. Often cultivated for ornament and the shade of its close foliage.

Naudea purpurea, Roxb. Cor. Pl. t. 54, Fl. Ind. i. 515, which has been confused with this species (Dalzell Bombay Fl. Suppl. 43) is a different tree, with purple flower-heads, capitate stigma, a 2-celled ovary, and a capsule splitting into 4 valves from the base.

2. **STEPHEGYNE**, Korthals.

Shrubs or trees, with opposite, petiolate leaves, and large caducous interpetiolar stipules. Flower-heads compact, globose, axillary and terminal, generally supported by 2 large bracts. Flowers surrounded by paleaceous bracteoles. Calyx-tube short, limb cup-shaped or tubular, truncate or indistinctly 5-dentate. Corolla funnel-shaped, tube elongate, glabrous or hairy inside, limb divided into 5 short, acute, valvate lobes. Stamens 5, filaments short filiform, inserted in the mouth or the upper part of the corolla-tube; anthers attached by the back, lanceolate, with a cordate base, apiculate. Ovary 2-celled, with a long filiform style, exserted, the stigma cylindrical, often with a concave base. Ovules numerous, imbricate, placentæ pendulous, or adnate to the dissepiment. Fruit globose, consisting of numerous dry distinct capsules, 2-valved, the valves dehiscing from the base, many-seeded. Seeds small, with a winged testa and fleshy albumen.

1. **S. parvifolia**, Korth.—Syn. *Nauclea parvifolia*, Roxb. Cor. Pl. t. 52, Fl. Ind. i. 513; Wight Ill. t. 123; W. & A. Prodr. 391; Bedd. Fl. Sylv. t. 34. Vern. *Kaddam*, *kallam*, *keim*, *kangei*. Local n. *Phaldu*, Kamaon; *Mundi marra*, Gonds, C.P.; *Kumra*, Banswara; *Htein thay*, Burm.

A large tree, pubescent or nearly glabrous. Leaves oval rotundate or obovate, varying much in size, 2-6 in. long, at times longer, on short petioles; main lateral nerves 6-8 pair, the lowest 2 pair from near the base of leaf. Stipules large, pale, obovate. Flower-heads light yellow, nearly white, 1 in. diam., on peduncles about twice the length of head, generally supported by 2 leaf-like, oblong bracts, narrowed into a long slender petiole. Bracteoles spathulate, as long as or somewhat longer than calyx-tube. Stigma cylindrical, with a concave base.

A common tree in the greater part of India and Burmah. Often gregarious, particularly in moist places. In the sub-Himalayan belt its western limit is the Bias river, but trees are found (doubtfully indigenous) as far as the Chenab, and it ascends to 4000 ft. The tree is leafless for a short time in spring; the new leaves come out in May. Fl. May-July; fr. Nov. Dec., often remains long on the tree.

50-60, at times 80 ft. high, with a short, erect, often irregularly-shaped trunk, sometimes buttressed, attaining a girth of 6-7, at times 10-12 ft. Bark thin, ⅛-¼ in. thick, bluish grey, sometimes brownish grey, with dark patches of old exfoliating scales, leaving exposed the inner lighter-coloured bark. At times marked with cicatrices, from which issues a whitish, afterwards rufescent gum. Wood grey to light-reddish brown, compact, close- and fine-grained, hard; weight 35-47 lb. per cub. ft. seasoned, 54 lb. green; value of P. 683 (Skinner), 586 (mean of 2 exp. by Cunningham). Durable, if not exposed to wet. No distinct heartwood. Medullary rays very numerous, very fine. Easily worked, and polishes well. Used for building, furniture, agricultural implements, combs, and to a large extent for turned and carved articles, platters, cups, spoons. The leaves are used for fodder.

To the same genus belongs *Stephegyne* (*Nauclea*) *diversifolia* of Burma (*Bingah*, Burm.)

3. **ADINA,** Salisbury.

Trees with opposite, petiolate leaves, and large interpetiolar caducous stipules. Flower-heads compact, globose, solitary or paniculate, with or without bracts, receptacle pilose. Flowers surrounded by paleaceous bracteoles. Calyx-tubes prismatic, limb 5-lobed. Corolla-tube elongate, funnel-shaped, glabrous inside, lobes 5, obtuse, valvate. Stamens 5, inserted in the mouth of the corolla-tube; anthers short, oblong, on short filaments, exserted. Ovary 2-celled; style filiform, exserted, stigma clavate or capitate, the placentæ pendulous, with numerous, imbricate ovules. Fruit dry, globose, of numerous distinct 2-valved capsules, dehiscent septicidally, sometimes separating from a persistent axis. Seeds oblong, winged at both ends, albumen copious, cotyledons plane, radicle terete superior.

1. **A. cordifolia,** Hf. & Benth.—**Tab. XXXIII.**—Syn. *Nauclea cordifolia*, Roxb. Cor. Pl. t. 53; Fl. Ind. i. 514; W. & A. Prodr. 391; Bedd. Fl. Sylv. t. 33. Vern. *Haldu, hardu.* Local n. *Tikkoe*, Baraich and Gonda (Oudh); *Hardu marrah*, Gonds, Satp. range; *Haldwa, uldu*, Banswara; *Hedu, heddi*, Konkan; *Hnawben*, Burm.

A large tree, branchlets, leaves, petioles pubescent. Leaves cordate, short-acuminate, 4-9 in. long, nearly as broad as long, with 5-7 pair of prominent main lateral nerves, the 2 lowest pair from the base; petioles half the length of leaf or longer. Peduncles axillary, as long as petioles, each bearing 1, rarely 2, globose yellow flower-heads, 1 in. diam. to tips of styles, which are long-exserted, with capitate stigmas. Receptacle pilose, with short, linear bracteoles. Corolla-tube pubescent outside. Fruit-head consisting of numerous distinct dry, pilose, clavate capsules; axis of capsule persistent, flat, membranous, linear, 1-nerved.

A common tree throughout the moister regions of India, extending in the sub-Himalayan tract to the Jumna, and ascending to 3000 ft. Not gregarious, and seedlings not numerous. The old leaves shed April-May, the tree is then leafless for a short time, until the new foliage comes out in May and June. Fl. June, July, often later; seeds ripen Dec.-March. Young leaves often eaten by the larva of a moth, in such vast numbers as to strip the tree of all foliage, which in that case is usually renewed during the rainy season.

Attains 80 ft. in North and Central India, but grows much taller in Burma and on the west side of India. Trunk straight, tall, often with large buttresses near the base, girth of 10-18 ft. not uncommon in the Kamaon Bhābar, many large spreading and ascending boughs, forming a broad rounded crown. Foliage light green. Bark 1-2 in. thick, grey or brownish grey, rough, with many longitudinal wrinkles and cracks, with a whitish pellicle on the smoothish persistent scales between the cracks. Inner substance of bark reddish brown, streaked with white, fibrous, laminated. Wood yellow, often changing when seasoning into a reddish nut-brown colour, with white specks, compact and fine-grained. No distinct heartwood. Skinner gives the weight of seasoned wood at 42 lb., and this agrees well with the results of my experiments, 42 (1862), 43 (1864). The extremes are 36.3 (Puckle) and 49 (Cunningham). The value of P. is given by Skinner at 664, which seems a likely average, and agrees well with Cunningham's experiments. In 1864 I obtained a higher average as the mean of 9 experiments—viz., 760, the extremes being 530 and 950. A valuable wood, for it is fairly durable. R. Thompson states that logs of it lying for years in the Kamaon forests were not touched by white ants or other insects, supposed to be protected by a bitter substance in the wood. In South India it soon decays when exposed to wet. Seasons well, works easily, takes a fine polish, and is good for turning, but is somewhat apt to warp and crack. Employed extensively in construction, for furniture, agricultural implements, opium-boxes, writing-tablets, gun-stocks, combs. Canoes are scooped out of the trunk.

To the same genus belongs *Adina* (*Nauclea*) *sessilifolia* of Burma (*Thitpayaung*, Burm.)

4. CINCHONA, Linn.

Evergreen shrubs or trees, with opposite, petiolate leaves, and interpetiolar, deciduous stipules. Bark bitter. Flowers white red or purple, odorous, in terminal panicles, with short, linear or subulate bracts, the lower branches in the axils of leaves. Calyx-tube turbinate, pubescent, limb 5-dentate, persistent. Corolla tubular, pubescent outside, with a flat spreading 5-lobed limb; lobes valvate, edge fringed with soft hairs. Stamens 5, inserted in the corolla-tube, with short or long filaments, anthers linear, attached to the back near the base. Ovary 2-celled; style slender, with 2 short obtuse branches, papillose inside. Ovules numerous, attached to linear placentæ adnate to the dissepiment. Capsule ovoid, oblong or cylindrical, 2-celled, 2-valved, dehiscing from the base septicidally. Seeds numerous, peltate, testa broadly winged, with denticulate or irregularly lacerated edge; albumen fleshy, cotyledons ovate, radicle terete.

This genus, though not indigenous in India, is of the greatest importance for the wellbeing of its inhabitants, on account of the powerful medicinal qualities which the bark of many of the species possesses. Their cultivation has been attempted in Kangra, and on the Satpura range of Central India; some notice therefore appears called for in this place. About 36 species are known, and they are distributed over a narrow belt along the range of the Andes or Cordilleras of South America, at elevations between 2300 and 8000 ft., principally along their eastern declivities, from lat. 19° south in Bolivia to lat. 10° north in Venezuela. The bark of about 15 species has important medicinal value, and most of these have been introduced into India since 1860, mainly through the labours of C. R. Markham, C.B., who was deputed to Peru in 1859 by the Secretary of State for India, and was most successful in organising a regular supply of plants and seeds of the different species. Mr Markham himself collected and brought to the coast, in spite of great difficulties, large quantities of seeds and plants of the *Calisaya* and other species from the Caravaya district in South Peru. Mr R. Spruce sent seeds and plants of the *C. succirubra* (red bark). Mr Cross collected seeds of *C. officinalis* and allied species in the province of

Loxa (crown bark); and the importation of *micrantha*, *peruviana*, and other grey-bark species of the Huanuco district, is due to Mr Pritchett. The plants collected by Mr Markham himself unfortunately perished on the voyage, but the seeds imported through the agency organised by him succeeded; and during a tour through Southern India in 1861, he selected the principal localities for plantations on the Nilgiris, and other hills on the west side of the Peninsula. The Government plantations on the Nilgiris have, since the commencement, been under the skilful superintendence of Mr M'Ivor. From Bengal the late Dr T. Anderson, then Superintendent of the Botanic Gardens, Calcutta, went to Java in 1862, brought from thence a supply of plants and seeds of various species, and established the Cinchona plantations in Sikkim with these, supplemented by plants and seeds from the Nilgiris, and by *Calisaya* seeds obtained from other sources. It will be sufficient to enumerate here the 4 principal species cultivated in the East Indian plantations, being the more valuable kinds of Ecuador, Peru, and Bolivia. Besides these there are several species in New Granada, the more important of which are: *C. lancifolia*, Mutis; Karsten Flora Columbiæ, i. t. 11, 12; and *C. pitayensis*, Wedd.; Triana, Nouvelles Etudes sur les Quinquinas, 1870, p. 61 (Syn. *C. corymbosa*, Karsten, l. c. t. 10, and *C. Trianæ*, Karsten, t. 22), remarkable by the corolla-tube hairy inside, and believed to yield the Pitayo bark, introduced into India by Mr Cross.

Leaves broad-oval; flower-panicles pyramidal; capsule oblong	1. *C. succirubra.*
Leaves oblong, obtuse, often narrow; flower-panicles pyramidal; capsule ovate	2. *C. Calisaya.*
Leaves lanceolate or ovate-lanceolate; panicles short-corymbose; capsules oblong or ovate-oblong	3. *C. officinalis.*
Leaves broad-ovate or obovate, decurrent into short marginate petiole, nearly glabrous; capsule lanceolate . . .	4. *C. micrantha.*

1. **C. succirubra**, Pavon; Howard Illustrations of the Nueva Quinologia of Pavon, 1862, t. 8.—Syn. *C. cordifolia*, var. *E.*, Mutis; Triana, l. c. t. 20, bis.

A tree, 15-40 ft. high, pubescent. Leaves without pits in the axils of lateral nerves, broad-oval, 6-10 in. long, 4-6½ in. broad, acute at both ends, nearly glabrous above, soft-pubescent or tomentose beneath; petiole 1-1½ in. long; main lateral nerves 8-10 pair. Stipules oblong. Flowers rose-coloured with white hairs; ½-¾ in. long, close together in large terminal panicles. Branchlets, nerves, and underside of leaves often red. Capsule oblong, 1-1¼ in. long. Varies with broader and narrower leaves, and with pale and pink flowers.

Indigenous in the warm and moist forests on the western and south-western slope of Chimborazo in Ecuador, north-east of Guayaquil, between 2300 and 5000 ft., but has probably a wider range. According to recent researches, this species yields the red bark of commerce, which is exported from Guayaquil, and which was long known and valued, though the tree yielding it had not been identified. Seeds and plants of this species were collected in the Limon forests west of the Chimborazo, and in the district of Guaranda, and sent to India by Mr R. Spruce in 1860; and from this source mainly have been raised the extensive plantations of *C. succirubra* on the Nilgiris and other hills of South India, and in Sikkim. The bark of this species is rich in Cinchonine and Cinchonidine, but comparatively poor in Quinine. The special advantage is that it thrives at lower elevations than any of the other species which yield valuable bark, but it is sensitive to frost and long-continued drought. In Sikkim it thrives at an elevation of 1000 ft. in the vicinity of the Sāl forest. It has been grown on the Chikalda hills in Berar, and on the Pachmarhis. The success of these experiments however, remains to be proved. In Burma it is grown on the hills east of Toungoo. The wood is close-grained, but not hard; the medullary rays are numerous, and the pores are arranged in linear radial groups of 3-5 between the medullary rays.

2. **C. Calisaya**, Weddell, Histoire naturelle des Quinquinas, 1849, t. 3.

A large tree, or a shrub when stunted. Leaves oblong, or obovate-oblong, obtuse, rarely acute, sometimes very narrow, 3-6 in. long, narrowed into a short petiole, glabrous, shining above, more or less pubescent beneath; main lateral nerves 6-8 pair, with more or less indistinct pits (scrobiculi) in their axils. Flowers less than ½ in. long, pubescent, light flesh-coloured, hairs white. Panicles large, terminal. Filaments generally shorter than half the length of anthers. Capsule ovate, ½ in. long. The shape of the leaves varies exceedingly.

Indigenous on the east side of the second Cordillera range, between 13° and 16° 30′ S. lat., in the northern districts of Bolivia and the province of Caravaya in Peru, at an elevation between 4800 and 6000 ft. A stunted variety, *B. Josephiana*, Wedd. l. c. t. 3, bis, with oblong-lanceolate, somewhat coriaceous leaves, was found by Weddell on grass-lands (Pajonal) outside the forests. These grass-lands he believes were formerly covered with forest which gradually receded from the inroads of the jungle-fires, and the stunted Calisayas remained. A similar encroachment of the grass-lands upon the forest by the action of the annual fires is not rare in India. The trees outside the forest, which resist the action of the fires, get stunted and gnarled, and often present a different aspect from the same species in the forest. *C. Calisaya* yields the Royal, also called Yellow or Calisaya bark, which is exported from Arica in south Peru. It is perhaps the most valuable of all Cinchona barks, rich in alkaloids, of which Quinine forms more than one-half, sometimes four-fifths.

In Sikkim, *C. Calisaya* thrives remarkably well at moderate elevations. It seeds freely, and proves a free and rapid grower. This species was first introduced into the Buitenzorg Botanic Garden in Java by Justus Carl Hasskarl, who was sent to Peru by the Dutch Government in 1852. A large proportion of his importations, however, consisted of a comparatively worthless species, *C. Pahudiana*, Howard (identified by Triana, l. c. 68 with *C. carabayensis*, Wedd.), with subcoriaceous, elliptic, not scrobiculate leaves, densely tomentose beneath, pink flowers, the corolla-tube pentagonous, with 5 longitudinal open slits on the edges, and pubescent capsules.

3. **C. officinalis**, Linn.; Bot. Mag. t. 5364.—Syn. *C. Condaminea*, Humb. et Bonpl.; Weddell, l. c. t. 4.

A large tree, leaves lanceolate or ovate-lanceolate, 3-6 in. long, narrowed into petiole 1 in. long or longer, glabrous, or slightly pubescent beneath, distinctly scrobiculate; main lateral nerves 8-10 pair, the pits in their axils distinctly visible on the upper side of leaf. Flowers pubescent, in short corymbose pubescent panicles, ½-¾ in. long, flesh-coloured, capsules oblong or ovate-oblong, ½ in. long or longer.

Indigenous in the forests of Loxa in Ecuador, on the east side of the Andes, at elevations between 6000 and 9000 ft. Produces the Pale, also called Loxa or Crown bark. Cultivated at high elevations on the Nilgiris and in

Ceylon. Rich in alkaloids, of which more than one-half is Quinine. Crown bark is yielded by several varieties or closely allied species, most of which have been introduced into the Indian plantations. In Howard's Nueva Quinologia the following are figured: 1. *C. Chahuarguera,* Pavon; 2. *C. crispa,* Tafalla; 3. *C. Uritusinga,* Pavon; 4. *C. heterophylla,* Pavon (identified by Triana l. c. 59 with *C. Chahuarguera,* Ruiz et Pavon),—all from the Loxa and other districts of Ecuador.

4. **C. micrantha,** Ruiz et Pavon; Weddell, l. c. t. 14, 15; Howard, l. c. t. 5.

A large tree. Leaves broad-ovate or obovate, 6-12 in. long, 4-8 in. broad, decurrent into a short marginate petiole, glabrous above, nearly glabrous beneath, with more or less distinct pits in the axils of the nerves. Main lateral nerves 10-12 pair. Flowers white, ⅓ in. long. Capsule lanceolate, ½ in. long.

Indigenous on the east side of the inner Cordillera in Peru and Bolivia. This, with *C. nitida,* Ruiz et Pavon; Wedd. l. c. t. 10, and *peruviana,* Howard, l. c. t. 27, yields the grey or silver barks which are rich in Cinchonine, though they contain no Quinine, or very little of it. The grey barks are cultivated on the Nilgiris and in Sikkim.

5. HYMENODICTYON, Wall.

Trees or shrubs, with opposite, petiolate, deciduous leaves. Bark bitter. Stipules interpetiolar, deciduous, glandular-serrate. Flowers small, pentamerous. Corolla funnel-shaped or narrow campanulate, pilose outside; lobes short, valvate. Anthers linear or oblong, filaments short, compressed, attached to the back of a broad connective. Disc annular. Ovary 2-celled; style filiform, long exserted, stigma fusiform, 2-lobed, ovules numerous, attached to cylindrical placentas adnate to the dissepiment. Capsule ovoid-oblong, 2-valved, dehiscing loculicidally. Seeds numerous, imbricate, testa winged, wing elongated, bifid below, edge lacerated; embryo small in a fleshy albumen.

Flower-spikes erect, in terminal panicles . . .	1. *H. excelsum.*
Flower-spikes drooping, axillary	2. *H. flaccidum.*

1. **H. excelsum,** Wall. in Roxb. Fl. Ind., ed. Carey, ii. 149; W. & A. Prodr. 392.—Syn. *Cinchona excelsa,* Roxb. Cor. Pl. t. 106; Fl. Ind. i. 529. Vern. *Bartu, barthoa,* Pb.; *Bhaulan, bhalena, bhamīna, dhauli,* N.W.P.; *Kūkūrkāt, bhūrkūr,* Oudh; *Bhohar, pōtūr, pūtūr,* C.P.; *Dondru, dandelo,* Panch Mehals.

A large deciduous and pubescent tree. Leaves elliptic or elliptic-oblong, acuminate, 6-12 in. long, main lateral nerves 8-10 pair. Stipules caducous, oblong, with a broad almost cordate base. Flowers greenish white, fragrant, very numerous, on slender pedicels in short clusters along the axis of dense cylindrical compound spikes, congregated in erect terminal panicles, the clusters in the axils of linear deciduous bracts, the spikes in the axils of long-pedunculate floral leaves or bracts, shaped like the leaves, but coloured and deeply reticulate. Corolla funnel-shaped, with a long slender tube, and a broad campanulate mouth. Capsules ¾ in. long, recurved on pedicels half their length or longer. *Cinchona thyrsiflora*, Roxb. Fl. Ind. i. 530, fr. Bengal, is probably the same species.

Forests of the Peninsula and Central India, extending on the west side as far north as the Panch Mehals. Burma, Bengal, Behar, Oudh forests, and sub-Himalayan tract, west to the Ravi, ascending to 5500 ft. in the outer Himalaya. Leafless from November until May or June. Fl. June, July. Capsules ripen Oct.-Jan., remain long on the tree, conspicuous on the bare branches. A small tree in the C.P., but attains a large size, h. 50 ft., g. 6-8 ft., in Oudh and the north-west, and much larger dimensions in Burma. Very common in the Oudh forests, associated with *Sāl* and *Haldu*, also in the outlying Scrub jungle. Bark 1 in. thick, cinereous or dark brown, smoothish or with elevated corky ridges, peeling off in large membranous scales. Middle bark purplish brown, inner bark white, streaked with red and orange. Wood light-coloured, soft, light, but close-grained. Heart and sap not distinct. Used for agricultural implements, scabbards, grain measures, palanquins, toys, and similar articles. The inner bark is bitter and astringent, and is used as a febrifuge; the bark is also used for tanning, and the leaves as cattle-fodder.

2. **H. flaccidum**, Wall. l. c. 152; Pl. As. rar. t. 188.

A moderate-sized glabrous tree. Leaves approximate at the ends of branchlets, elliptic, acuminate, 6-10 in. long, main lateral nerves 8-10 pair. Stipules deciduous, oblong with narrow base. Flowers white, numerous, sessile, fasciculate in dense cylindrical, pedunculate, drooping, axillary spikes, each spike with one long pedunculate coloured reticulate floral leaf on the peduncle. Capsules ½ in. long or less, reflexed, on short pedicels.

Hills of Eastern Bengal. Nepal, outer Himalaya, as far as the Jumna, ascending to 5000 ft. Fl. June, July. Capsules ripe Oct., and remain long on the tree. Bark cinereous or brown, somewhat rugose. Leaves red before being shed.

H. obovatum, Wall.; Bedd. Fl. Sylv. t. 219, on the hills of the western coast as far north as Bombay, has elliptic or obovate leaves, on long petioles, pubescent beneath, finely reticulate between 6-8 pair of main lateral nerves, flowers subsessile, fasciculate in erect spikes, each spike with a coloured floral leaf, forming short terminal panicles.

6. WENDLANDIA, Bartling.

Shrubs or small trees, leaves opposite and in whorls of three. Stipules interpetiolar or intrapetiolar. Flowers small, supported by bracteoles in many-flowered terminal panicles. Calyx-tube subglobose, limb with 5 nearly equal persistent lobes. Corolla tubular, limb spreading, of 5 imbricate lobes. Anthers versatile, exserted. Ovary 2- rarely 3-celled, style slender, stigma bifid, but lobes often cohering. Capsule globose, crustaceous, 2-valved, many-seeded. Seeds compressed horizontal, testa membranous, sometimes narrow-winged, embryo short in a fleshy albumen.

Grey-tomentose; stipules recurved; corolla-tube short; filaments as long as anthers . . . . 1. *W. exserta.*
Nearly glabrous; stipules adpressed; corolla-tube long; filaments shorter than anthers . . . . 2. *W. tinctoria.*

1. **W. exserta**, DC.; W. & A. Prodr. 402.—Syn. *Rondeletia exserta*,

Roxb. Fl. Ind. i. 523. *R. cinerea*, Wall. Fl. Ind., ed. Carey, ii. 141. Vern. *Chaulai, chila, chilkiya, tīla*, Kamaon; *Birsah, tilki*, Oudh; *Kūrsi*, Seoni district; *Marria kari*, Gonds of Chindwara; *Tīlliah*, Baigas of Mundla.

A small tree, grey-tomentose. Leaves opposite, lanceolate or ovate-lanceolate, entire, pubescent above, clothed with short soft grey tomentum beneath, 6-9 in. long, main lateral nerves prominent, 16-20 pair. Stipules interpetiolar, ovate, upper part recurved. Flowers white, fragrant, in large tomentose panicles. Lobes of corolla reflexed, as long as tube. Filaments exserted, as long as anthers.

Common in South and Central India, Bengal and in the sub-Himalayan tract as far west as the Chenab. Abundant in the Baraitch and Gonda forests of Oudh, where in some places it grows in dense patches to the exclusion of other trees. Common on the Nerbudda, particularly in broken, raviny ground. Very abundant and of large size in the vicinity of the Pachmarhis. Fl. March, April. Generally only about 25 ft. high with 3 ft. girth, but in places attains 50 ft. and 5 ft. girth. Trunk short crooked or forking, branches upright. Foliage pale green. Bark rough, with longitudinal shallow cracks, exfoliating in long strips. Wood reddish, close-grained, extremely hard, fibrous and tough; though small, used for building and agricultural implements.

2. **W. tinctoria**, DC.—Syn. *Rondeletia tinctoria*, Roxb. Fl. Ind. i. 522.

A small tree, nearly glabrous, flower-panicles and under side of leaves pubescent. Leaves opposite, elliptic-oblong or obovate-oblong, acuminate, narrowed into short petiole, shining above, pubescent or glabrate beneath, main lateral nerves 10-12 pair, prominent. Stipules interpetiolar, adpressed, triangular-ovate, cuspidate with a long apex. Flowers white, sessile, fascicled, in large hairy panicles. Corolla-tube four times the length of the recurved lobes. Anthers exserted, on very short filaments.

Bengal, Behar, Nepal, Oudh forests (Gonda), Kamaon. Fl. Jan.-March. 20 ft. high, with a short crooked stem 3 ft. girth. Bark employed in Bengal as a mordant in dyeing.

7. GARDENIA, Linn.

Shrubs or trees, the young shoots often exuding a resinous gum. Stipules solitary on each side, entire, more or less connate round the stem within the petioles, often early deciduous. Calyx-limb produced beyond the ovary, truncate, toothed or divided into 5 or more lobes. Corolla-tube cylindrical, or slightly dilated upwards, lobes 5 or more, contorted in the bud. Anthers nearly sessile, usually more or less exserted. Ovary 1-celled, incompletely divided by 2, 3, or rarely more projecting parietal placentæ, with several ovules to each placenta. Fruit fleshy, indehiscent, usually crowned with the limb of the calyx, endocarp often hard and imperfectly 2-5-celled. Seeds numerous, immersed in the fleshy or pulpy placentæ.

Armed with strong axillary, often leaf-bearing spines; calyx truncate with 5 short subulate teeth. Fruit grey, 2-3 in. long . . . . 1. *G. turgida.*
Unarmed; flowers 5-6-merous; limb of calyx short.
  Limb of calyx with 5 or 6 ovate or triangular divisions;

fruit oblong; leaves cuneate-oblong, sessile, with broad, often cordate base . . . . 2. *G. gummifera.*
Limb of calyx with 5 long, subulate divisions; fruit ovoid; leaves elliptic-oblong, narrowed into short petiole . 3. *G. lucida.*
Unarmed; flowers 9-merous; limb of calyx tubular, deeply cleft into 9 lanceolate hirsute segments; fruit nearly globose, leaves obovate, narrowed into short petiole . . . 4. *G. latifolia.*

1. **G. turgida,** Roxb. Fl. Ind. i. 711; Wight Ic. t. 579.—Vern. *Thanella,* N.W.P.; *Khūrrūr, khūriari,* Oudh, Singrowlee, Mirzapur, Mundla, Sioni, Chindwara; *Ghūrgā,* Oudh; *Pendra, Phendra marra,* Gonds, C.P.

A small tree. Branches with thick soft, mealy, grey, rarely light rust-coloured bark, armed with strong axillary, often leaf-bearing spines. Leaves greyish green, soft-tomentose beneath, pubescent above, rarely (specimens from South India) nearly glabrous, obovate, obtuse or short-acuminate, sessile, with a long tapering base, and 4-6 pair of main lateral arcuate nerves. Stipules interpetiolar, distinct, triangular. Flowers 1-4, axillary or at the end of short leafless lateral branchlets. Calyx short, campanulate, limb truncate with 5 short subulate teeth. Corolla white, fragrant, tube 3 times the length of calyx, limb with 5 oblong divisions, longer than tube. Fruit ovoid or turbinate, grey, rough, 2-3 in. long, with 9 obtuse longitudinal ridges at the base, crowned with the scar of calyx; shell of nut hard, bony, 5-valved.

Sub-Himalayan tract from the Kali to the Jumna, ascending to 4000 ft. Aravalli hills near Todgarh (*Karumba*), Banswara (*Gangāli*). Common in the Oudh forests, Behar. South India (the glabrous form, and limb of calyx more distinctly lobed). Old leaves shed in March, young foliage in May; fl. generally March and April. Barely 15 ft. high, with a short erect trunk, 2½ ft. girth, bark ½ in. thick, spongy, white or rusty farinaceous. Wood dirty white, with darker streaks, close-grained, hard, 56½ lb. per cub. ft. (R. T.) Splits and cracks in seasoning. Fruit not eaten, but used medicinally (in Kamaon).

2. **G. gummifera,** Linn.; Wight Ic. t. 576; Roxb. Fl. Ind. i. 708, 709 (*G. arborea*); W. & A. Prodr. 395.—Vern. *Dekāmāli, kamarri, karmarri,* C.P.

A large shrub, rarely a small tree, nearly glabrous, unarmed, leaves pubescent when young, rough when old, buds resinous. Leaves sessile, often with cordate base, cuneate-oblong or obovate-oblong, 2-3 in. long, with 12-16 pair main lateral nerves, stipules sheathing. Flowers terminal, 1-3 together, almost sessile. Calyx pubescent and scabrous, limb short, with 5-6 ovate, or triangular divisions. Corolla large, white, yellow in the evening, fragrant, tube 1½-2 in. long, limb spreading, segments narrow, oblong, half the length of tube, almost glabrous. Stigma clavate, entire, striated. Fruit oblong, with numerous longitudinal, elevated lines, 1-1½ in. long, crowned with persistent calyx. Nut with a thin crustaceous shell, nearly 4- or 5-celled.

Ceylon, South India, and Satpura range, C.P. Bare of leaves until the end of the hot weather; fl. March, April, before the new leaves come out. Branchlets rough, reddish. Wood white and hard; the fruit is eaten. From wounds in the bark exudes a beautiful yellow gum-resin, which is collected and sold with the gum of *G. lucida.*

To the same group of Gardenia belongs *G. florida*, Linn.; Bot. Mag. t. 2627, 3349, with oblong-elliptical coriaceous leaves, 2-4 in. long, acuminate, narrowed into short petiole, with 6-10 main lateral nerves, calyx-segments linear, nearly 1 in. long, fruit oblong, above 1 in. long, crowned by the persistent calyx-segments. Indigenous in China, and cultivated throughout India on account of its large white fragrant flowers.

3. **G. lucida**, Roxb. Fl. Ind. i. 707; Wight Ic. t. 575; W. & A. Prodr. 395.—Vern. *Dikamali*. Local n. *Konda manga, kokkita, tetta manga*, C.P.

Glabrous, unarmed, with resinous buds. Leaves elliptic-oblong, acute, or short-acuminate, narrowed into short, marginate petiole, 3-10 in. long with 20-25 pair main lateral nerves; stipules sheathing, cut into unequal segments. Flowers large, solitary, on pedicels ½-1 in. long from the axils of the uppermost leaves near the ends of branches. Limb of calyx with 5 long linear-subulate divisions. Corolla large, pure white, fragrant, tube long, glabrous, striated, limb spreading, with 5 obovate-oblong lobes, as long as or a little shorter than the tube, glabrous. Stigma entire. Fruit oblong or ovoid, smooth, marked with longitudinal lines, crowned with the persistent calyx; shell of nut hard, woody, thick, nearly 2-celled by the prominent placentæ.

Burma, South India, and Central Provinces. Fl. March-June; fr. C.S. A large shrub or a small tree 25 ft. high, trunk short erect, 3 ft. girth, numerous stiff decussate branches. Young shoots greyish-green, smooth, resinous. Wood close-grained, hard, is made into combs, and is recommended for turning. A gum-resin (*dikamāli*) exudes from wounds in the bark, is collected and sold in the bazar, hard opaque, yellow greenish or brown, with a strong smell. Useful in the treatment of sores and cutaneous diseases, and for keeping off flies and worms.

4. **G. latifolia**, Aiton; Hort. Kew. i. 369; W. & A. Prodr. 395; Wight Ic. t. 759. Vern. *Papra, pāphar*, C.P.; *Ban pindālu*, N.W.P.; *Pannia-bhil*, Gonds, Mandla; *Gūngat, bhandāra*, Gonds, Satpura; *Phiphar*, Baigas, Balaghat.

A small tree; nearly glabrous, young leaves pubescent, mature leaves dark green and glossy. Leaves opposite or in threes, oval or obovate, entire, narrowed into short petiole, with 10-20 pairs of prominent lateral nerves, and small, hairy glands in the axils of the nerves on the under side. Stipules connate in a sheath round the stem within the petioles. Flowers terminal, generally solitary, nearly sessile. Limb of calyx campanulate, deeply and irregularly cleft into generally 9 lanceolate hirsute segments. Corolla large, white in the morning, yellow in the evening, fragrant, tube 2-3 in. long, hirsute on the outside; limb spreading, divisions generally 9, obliquely obovate, hairy, on the outer edge overlapping in the bud, as long as the tube, or equal to half its length. Stigma clavate, thick and fleshy. Fruit nearly globose, 1¼-2½ in. long, adpressed pilose when young, when ripe cinereous or speckled greenish yellow, crowned with the lower part or the whole of calyx, and enclosing a nut, with a thin, hard, but brittle shell, bearing on the inside 4 or 5 parietal placentæ.

Common in dry places, in many parts of India, in the sub-Himalayan forests ascending to 3000 ft., north-west as far as the Jumna, in Bengal, Behar, Central India, South India, and Ceylon. Trunk short, 3 and at times 4 ft. girth, with stiff divergent branches, forming a small rounded head, up to 30 ft. high. New leaves in the beginning of May; fl. in April and May; the fruit ripens in the ensuing cold season. Bark ⅓-½ in. thick, white, grey or greenish, scurfy and farinaceous, but upon the whole smooth. The wood is white, with a yellowish tinge, close- and fine-grained; it weighs when dry 52-53 lb. per cub. ft., is easy to work, and durable; combs are made of it, and it has been recommended for engraving and turner's work. Annual rings distinct.

A tree figured in Roxb. Cor. Pl. t. 134, and described in that work, and in Fl. Ind. i. 706, under the name of *G. latifolia* (*G. enneandra*, König; W. & A. Prodr. 394; Wight Ic. t. 574), from the Circars and the Carnatic, has the lobes of the corolla as long as the tube (no constant character in this group), and the calyx-limb short-dentate. Roxburgh identifies it with Aiton's *G. latifolia*, but thinks it different from that plant as figured by Gärtner, Carp. iii. t. 193. The question, whether the plant described and figured by Roxburgh is specifically distinct from *G. latifolia*, Ait., as here described, demands farther inquiry.

8. RANDIA, Linn.

Shrubs or rarely trees, often armed with opposite axillary thorns. Stipules solitary on each side, pointed, with a broad base, but not united, often deciduous. Calyx-limb more or less produced beyond the ovary, truncate, toothed or lobed. Corolla-tube cylindrical, short or long, rarely dilated at the top; lobes 5, contorted in the bud. Anthers nearly sessile, included in the tube or exserted. Ovary 2-celled, with several, usually numerous ovules in each cell, attached on the dissepiment to a fleshy placenta. Fruit succulent, indehiscent, often crowned by the calyx-limb. Seeds numerous, immersed in the fleshy or pulpy placenta.

Corolla-tube glabrous, much longer than calyx; fruit a small 4-seeded berry, ¼ in. long	1. *R. tetrasperma.*
Corolla-tube hairy, short; fruit large, more than 1 in. long.	
Branches rust-coloured; spines 1-4, at the end of short branchlets; calyx with 5-8 short obtuse lobes; fruit grey, 2 in. long	2. *R. uliginosa.*
Branches grey; spines axillary; calyx with 5 broad ovate foliaceous divisions; fruit yellow, 1-1½ in. long . .	3. *R. dumetorum.*

1. **R. tetrasperma**, Benth. & Hook.—Syn. *Gardenia tetrasperma*, Roxb. Fl. Ind. i. 709, ed. Carey, ii. 555. Vern. *Bara garri*, Kamaon.

A small shrub, with grey, decussate, stiff branches, and short, often spinescent branchlets. Leaves glabrous, ½-2 in. long, obovate or oblanceolate, narrowed into short petiole, approximate near ends of branchlets; stipules triangular-subulate. Flowers greenish-white, scented, sessile, pentamerous. Calyx-lobes as long as tube, subulate from a triangular base. Anthers exserted. Corolla-tube ⅓ in. long; lobes nearly as long, oblong; apex subulate. Stigma long, spindle-shaped. Fruit a globose berry, crowned with the persistent calyx, ¼ in. long, 4-seeded.

Himalaya from Indus to Bhutan. In North-West Himalaya ascends to 6000 ft. Fl. April, May.

Nearly allied is *R. rigida*, DC. (*Posoqueria rigida*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 570); a rigid shrub about 6 ft. high, pubescent, with short, sharp axillary spines, ¼-⅓ in. long, and ovate, acuminate leaves on short petioles, with cordate or rounded base, white fragrant flowers in axillary, nearly sessile fascicles; corolla-tube ¾ in. long; berries small, many-seeded, globose purple. Eastern Himalaya and Nepal. Probably also in Kamaon.

2. **R. uliginosa**, DC.; W. & A. Prodr. 398; Wight Ic. t. 397.—Syn. *Gardenia ul.*, Roxb. Pl. Cor. t. 135; *Posoqueria ul.*, Roxb. Fl. Ind. i. 712. Vern. *Pindālu*, *pindāra*, Kamaon; *Panār*, Oudh; *Paniah*, Gorakhpur; *Bharani*, *kātūl*, C.P.; *Kaurio*, Panch Mehals; *Mhaniben*, Burm.

A tall shrub or small tree; nearly glabrous, trunk and branches with dark, rust-coloured bark. Smaller branches quadrangular, bearing short, round, diverging, decussate branchlets, with several pair of approximate leaves, 1-3 flowers, and at the top 1-4 strong sharp decussate thorns, about ½ in. long. Leaves shining, smooth above, pubescent with short scattered hairs beneath particularly along the nerves, obovate, or obovate-oblong, from cuneate base, with 6-8 pairs of main lateral nerves; petioles short. Limb of calyx tubular, obtusely 5-8-toothed or nearly entire, a little shorter than the tube of the corolla, which is large, showy, white or cream-coloured, with a broad spreading limb of 5-8 round obtuse lobes; mouth of tube shut up with a ring of close white hairs. Fruit ash-coloured, crowned with persistent calyx, 2-celled, ovoid, 2 in. long, with a thick hard dry pulp.

Common in many parts of India. In the sub-Himalayan forests as far west as the Jumna, ascends to 2500 ft. Panch Mehals, Oudh, Central Provinces, South India, Bengal, and Burma. Often gregarious, mostly in low, moist places. Fl. May-June; fr. Dec.-Feb. Leaves shed Feb., renewed April. 15-20 ft. high, with short erect trunk, 2 ft. girth. Branchlets decussate, horizontal, with spines and flowers at their extremities. Bark 1 in. thick, dark-rusty, rough with brown scales. Foliage dark or bright green. Wood whitish, close-grained, hard, 41 lb. per cub. ft. Fruit sold in bazaars of Oudh and Behar, eaten when cooked or roasted. Leaves browsed by deer and cattle.

2. **R. dumetorum**, Lam.—Syn. *Gardenia dumetorum*, Roxb. Cor. Pl. t. 136; (*Posoqueria*), Roxb. Fl. Ind. i. 713; Wight Ic. t. 580; W. & A. Prodr. 397. Vern. *Mindla*, *mandkolla*, Pb.; *Arara* (the shrub, Aitch. Cat. 71), Hushiarp.; *Mainphal*, *mānyūl*, *karhar*, N.W.P.; *Main*, *maini*, Oudh; *Mainhūrī*, *manneul*, C.P.

A shrub or small tree, armed with strong opposite axillary spines 1-1½ in. long. Leaves obovate, acute, from cuneate base, narrowed into a short marginate petiole, rough on both sides with short stiff hairs, rarely glabrous; main lateral nerves 4-6 pair. Flowers greenish-yellow or nearly white, fragrant, at the ends of short lateral leaf-bearing branchlets, solitary or 2-3 together, on short peduncles. Calyx campanulate, strigose with stiff adpressed hairs; limb with 5 broad-ovate foliaceous divisions. Corolla white; tube short, not much longer than calyx-lobes, strigose with stiff adpressed hairs; limb spreading, its divisions oval or oblong. Fruit globose or ovoid, yellow when ripe, 1-1½ in. long, with a thick, firm fleshy pericarp; kernel cartilaginous, 2-celled, the seeds embedded in a quantity of gelatinous pulp, attached to the middle of the partition. *R. longispina*, DC.; W. & A. Prodr. 398; Wight. Ic. t. 582; is probably the same species.

Exceedingly common in most parts of India, extending north-west to the Bias river, and ascending in the outer Himalaya to 4000 ft. Ceylon, Java, and South China. In Kamaon and Garhwal abundant in some of the Sāl forests, also in the Gonda and Baraitch divisions of the Oudh forests. Loses its leaves Feb.-April; new foliage April-May. Fl. generally March-May; fr. Nov.-March. Very variable in habit and size, from a small stiff shrub to a handsome small tree, 15-20 ft. high, with a straight, often ridged and furrowed trunk, 2-4 ft. girth, with numerous thin, rigid branches, forming a rounded rather open crown. Bark ½ in. thick, cinereous or brownish-grey, rough with white elevated dots, wrinkled but not marked with cracks or furrows; at times quite white and smooth. Sapwood large, dirty-white, heartwood light brown, fine- and even-grained, compact, firm, hard, heavy and strong. Liable to warp. Used for agricultural implements, fences, and fuel. Bark of root and stem, and the fruit are used in native medicine. The unripe fruit is bruised, pounded, and used to poison fish; when ripe it is roasted, and eaten. The leaves are lopped and used as cattle-fodder. Growth slow; a section of a tree known to be 65 years old, 4 in. radius, hollow inside, showed 54 annual rings on 2 in. of the radius near the circumference.

9. HYPTIANTHERA, W. & A. Prodr.

Shrubs, wholly glabrous, with terete branches, and interpetiolar, triangular acuminate, persistent stipules. Flowers small, white, sessile in opposite axillary fascicles, bracteolate. Calyx-tube short, turbinate; limb cleft into 5, somewhat unequal, acuminate, persistent lobes. Corolla-tube short, pilose within; lobes 4-5, contorted in bud. Anthers 4-5, sessile on the corolla-tube. Ovary 2-celled; style short, with 2 large oblong, hirsute branches. Fruit an ovoid or globose, 2-celled, 6-10-seeded berry. Seeds imbricate; embryo small in a horny albumen.

1. **H. stricta**, W. & A. Prodr. 399.—Syn. *Randia stricta*, Roxb. Fl. Ind. i. 526.

Leaves lanceolate, shining, 3-5 in. long, on short petioles; main lateral nerves arcuate, joined by distinct intramarginal veins.

Bengal, Oudh forests, common on shady banks of streams. Generally a shrub, with many stems from one root, at times a small tree, 15-20 ft. high, with short erect trunk. Evergreen. Fl. April.

10. IXORA, Linn.

Shrubs or small trees, mostly glabrous. Leaves opposite, coriaceous, evergreen; stipules interpetiolar. Flowers in trichotomous corymbs. Calyx-tube ovoid, limb short, persistent, 4- rarely 5-dentate. Corolla hypocrateriform; tube slender, limb of 4, rarely 5 lobes, generally shorter than tube, contorted in bud. Stamens inserted in the mouth of the corolla, filaments short. Ovary 2-celled; style filiform, with 2 short exserted branches, 1 ovule in each cell. Fruit a coriaceous or fleshy 2-seeded berry with chartaceous endocarp. Testa membranous, albumen cartilaginous, embryo incurved at the back of the seed, radicle inferior.

1. **I. parviflora,** Vahl; Roxb. Fl. Ind. i. 383; W. & A. Prodr. 429; Bedd. Fl. Sylv. t. 222.—*The Torch-Tree.* Vern. *Gandhal,* Hindi; *Rangan,* Bengal; *Kauria,* Sadri, Meywar; *Kurat,* Bombay.

A large shrub or small tree, wholly glabrous. Leaves short petiolate, coriaceous, hard, shining, cuneate- or obovate-oblong, often with a slightly cordate base, 4-5 in. long, with prominent reticulate veins, and about 10 pair of more or less prominent lateral nerves. Stipules triangular, subulate. Flowers white or pink, $\frac{1}{3}$-$\frac{1}{2}$ in. long, in terminal corymbose trichotomous panicles.

Common in South India, extending north to the Satpura range. Bengal, Behar, Ceylon. Fl. March, April. The green branches make excellent torches, and are used for that purpose by Dāk runners. The wood is fairly close-grained.

I. coccinea, Linn.; Roxb. Fl. Ind. i. 375; W. & A. Prodr. 427.—Syn. *I. Bandhuca,* Roxb.; *I. grandiflora,* Ker; the *Flame of the Woods* (Sans. *Bandhuka, raktaka*); with oblong sessile leaves on a cordate base, bright scarlet flowers 2 in. long, in short compound terminal corymbs, is indigenous in South India, Chittagong, Burma, the Indian Archipelago. Cultivated in gardens all over India, and in most tropical countries. Naturalised in North Australia. Fl. throughout the year, particularly during the rains.

11. PAVETTA, Linn.

Shrubs and small trees, glabrous pubescent or tomentose. Leaves opposite, petiolate, mostly membranous. Stipules intrapetiolar, deciduous, generally connate into a sheath. Flowers in trichotomous corymbs, white or greenish. Corolla hypocrateriform; tube slender, lobes 4-5, stamens inserted in the mouth of corolla. Ovary 2-celled; style long, slender, filiform, stigma fusiform undivided or 2-dentate; ovule one in each cell attached to the dissepiment. Fruit a fleshy 2-seeded berry, with chartaceous endocarp. Testa membranous, albumen corneous, embryo incurved at the back of the seed, radicle inferior.

1. **P. tomentosa,** Smith; W. & A. Prodr. 431.—Syn. *Ixora tomentosa,* Roxb. Fl. Ind. i. 386; Wight Ic. t. 186. Vern. *Jūi,* Beng.

A large shrub; branchlets, leaves, and inflorescence clothed with short tomentum. Leaves ovate or ovate-oblong, 5-8 in. long, on petioles 1 in. long; main lateral nerves 10-15 pair. Flowers white, faintly fragrant, in broad spreading trichotomous panicles. Corolla, before opening, 1 in. long, lobes $\frac{1}{4}$ in. long.

South India, Burma, Bengal; common in the outer Himalayan ranges of Garhwal and Kamaon, ascending to 4000 ft. Fl. March, April.

P. indica, Linn.; W. & A. Prodr. 431 (*Ixora Pavetta,* Roxb. i. 385), glabrous, with lanceolate or oblong-elliptic leaves on short petioles, 8-10 main lateral nerves, white flowers in broad flat-topped trichotomous corymbs, is a common deciduous shrub in South India as far north as Bombay, and probably on the south face of the Satpura range. Abundant in Bengal. Fl. April, May.

Plectronia didyma, Benth. & Hook.—Syn. *Canthium didymum*, Gærtn.; Bedd. Fl. Sylv. t. 221; *C. umbellatum*, Wight Ic. t. 1034; Dalz. & Gibs. Bomb. Fl. 113; is a beautiful evergreen tree 30 ft. high, with dark-green, oval, short-acuminate coriaceous leaves, and white flowers in axillary umbels on short peduncles. Corolla-segments valvate, tube hairy inside at the mouth. Drupes ⅓ in. long, numerous, on slender pedicels, compressed, with two lateral furrows, almost didymous. South India, common along the western Ghats, possibly in the Central Provinces. Wood yellowish, with irregular masses of black wood in the centre, close-grained hard and heavy. Vern. *Arsūl*, Bombay.

12. **COFFEA**, Linn.

Shrubs, mostly glabrous. Leaves opposite, rarely in whorls of 3. Stipules interpetiolar, broad, acuminate, persistent. Flowers white, sessile or on short pedicels, solitary or fascicled in the axils of leaves. Calyx-tube short, with a short, truncate or dentate limb. Corolla hypocrateriform or funnel-shaped; lobes 4-5, oblong, obtuse, patent, contorted in bud. Stamens inserted in the mouth of the corolla; anthers sessile, or attached to short filaments at the back near the base. Ovary 2-celled, style bifid at the top; ovule one in each cell attached to the dissepiment. Berry globose or oblong, dry or fleshy, 2-seeded, each seed enclosed in a coriaceous or chartaceous endocarp (the husk of the coffee). Seeds plano-convex, the inner side flat, with a deep longitudinal furrow, filled up by the testa and a portion of the endocarp. Embryo curved, at the back and near the base of the horny albumen, cotyledons foliaceous, radicle inferior.

1. **C. arabica**, Linn.; Roxb. Fl. Ind. i. 539; Wight Ic. t. 53. *Coffee.* —Vern. The bean *Bun*, when roasted and ground *Kahwa.*

A glabrous shrub or small tree. Leaves 5-7 in. long, opposite, oblong, acuminate, narrowed into short petiole; main lateral nerves 6-10 pair, joined by intramarginal veins, and slender parallel reticulate veins. Flowers numerous, in axillary fascicles. Corolla funnel-shaped, lobes oblong, as long as tube. Filaments ⅓-½ the length of anthers. Berry fleshy, purple when ripe.

Indigenous in Abyssinia, and in Soudan, where it is said to form large forests. The use of coffee has long been known in Abyssinia, but it is not certain when the shrub was first cultivated. In Arabia it has been cultivated since the fifteenth century; there is, however, no proof of its being indigenous in that country. In the sixteenth century coffee became known in Europe, and in America its cultivation was commenced in 1718 by the Dutch in Surinam. Coffee was grown in Java in the latter half of the seventeenth century. It is said that into India it was first introduced (last century) by a Musalman saint, who lived and died on the summit of the great mountain in the Shimoga division of Mysore, called after him Baba Buden, that he brought the coffee-tree from Arabia, and planted it near his dwelling, whence it gradually spread to other parts of the country (Bowring, Eastern Experiences, p. 157). The coffee-tree accommodates itself readily to a moist climate, and under the influence of a rainfall of 100 inches on the Ghats of Munzerabad, Coorg, and Wynad, produces coffee similar in quality to that grown in Egypt, Arabia, and other countries, with a comparatively dry climate. It thrives in Chota Nagpur, on the Chikalda hills in Berar, and elsewhere in Central India. In the Dehra

Doon it grows freely, and produces fruit abundantly, but requires to be protected against frost while young. It is remarkable that coffee and tea contain the same substance, an alkaloid (Coffeine or Theine), to which (partly at least) the effect upon the nervous system of coffee and tea must be attributed. Tea contains between 1 and 3½ °/₀ of this substance, and coffee between ½ and 1 °/₀. Coffeine is also found in the Maté or Paraguay tea, *Ilex paraguayensis*, in the *Rola*, *Korra*, or *Gorra* nuts, the seeds of a sterculiaceous tree, *Cola acuminata*, R. Br.; Bot. Mag. t. 5699, of tropical Africa, cultivated in Brazil and the West Indies, which form an important article of trade, and are chewed by the negroes of West Africa and the West Indies as a condiment. It is also contained in the seeds of a sapindaceous tree (*Paullinia sorbilis*, Mart.) in Brazil, which are powdered and made into a paste, called *guarana* bread; used to make a refreshing drink.

Coffea bengalensis, Roxb. Fl. Ind. i. 540; Bot. Mag. t. 4917; *Kath-jahi*, Kamaon; is a small shrub with large snow-white flowers, solitary or in pairs, and ovate, long-acuminate leaves. Eastern Bengal, Sikkim, and the outer hills of Kamaon. Fl. Feb.-March.

13. MORINDA, Linn.

Shrubs or trees, leaves opposite, rarely in whorls of three, generally membranous. Stipules interpetiolar, or connate into a sheath. Flowers white, sessile on a globose receptacle, forming globose or ovoid flower-heads, with the calyx-tubes often connate. Calyx-limb truncate or obscurely dentate, persistent. Corolla funnel-shaped, or hypocrateriform; lobes coriaceous, 5, rarely 4 or 6-7, valvate in bud. Stamens inserted in the mouth of corolla; filaments short, anthers attached by the middle of the back. Ovary 4-celled, 1 ovule in each cell, attached to the dissepiment below the middle (normally 2-celled, but the 2 cells are converted into 4 by the introverted carpellary leaves being so produced laterally, as to reach the walls of the ovary—Thwaites); style with 2 stigmatic lobes, rarely entire. Drupes of each flower-head distinct or united in a compound succulent berry, including a number of hard 1-seeded pyrenes, usually 2-4 proceeding from each flower.

1. **M. exserta**, Roxb. Fl. Ind. i. 545; W. & A. Prodr. 419.—Sans. *Achyuta.* Vern. *Al*, *Ach*, *ack.* Local. *Alleri*, *Allādi*, Panch Mehals; *Ainshi*, North Konkan.

A moderate-sized tree, glabrous or pubescent. Leaves opposite, narrowed into short marginate petioles, ovate or elliptic-oblong, 4-5 in. long, main lateral nerves 8-10 pair. Stipules triangular or ovate. Peduncles mostly solitary, leaf opposed by the abortion of the axillary leaf, 1 in. long or longer. Corolla-tube ¾ in. long. Stamens exserted. Style bifid. Drupes concrete into a fleshy syncarpium, irregularly ovoid or globose, ¾-1½ in. long.

Indigenous in many parts of India, in Bengal, Burma, the Peninsula, the Panch Mehals. A fast-growing tree 30-40 ft. high, with a deeply-cracked spongy bark of greyish yellow colour. Fl. March-June. Blossoms and bears seed at a very early age. Wood bright yellow, darkening into yellowish brown; made into plates and dishes. The bark of the root is used for dyeing red and yellow. Skinner gives the weight of the wood of *M. citrifolia* at 30 lb. What he enters under *M. exserta* from Burma is a *Randia*, possibly *R. uliginosa*.

Roxb. Fl. Ind. i. 541-546, describes 4 species closely allied to this, which are important, as the root of all is used for dyeing. 1. *M. citrifolia*, Linn., from Pegu, with glabrous, lucid leaves. 2. *M. tinctoria*, Roxb., cultivated throughout India, with glabrous, but not lucid leaves. 3. *M. bracteata*, Roxb.; Wight Ill. t. 126, from Ganjam, glabrous, flower-heads supported by a few linear-lanceolate bracts, adnate to the calyx-tubes of outer flowers. 4. *M. multiflora*, from Nagpore and Berar, downy, peduncles often opposite, axillary, the end of the branch forming a short panicle. These 4 species have the anthers not exserted, the stipules are interpetiolar, free, or only connate at the base, not sheathing. I am inclined, however, to think that the wild and cultivated plant cannot be specifically distinguished, and that it will be more convenient to consider the 5 species described by Roxburgh as one, which would then be called *M. citrifolia*, Linn. Beddome, Fl. Sylv. t. 220, unites *M. citrifolia* and *tinctoria*, and Thwaites, Enum. Pl. Ceyl. 145, points out that the presence of bracts and the exserted anthers are variable characters. *M. citrifolia*, Linn., is found in Java and other islands of the Indian Archipelago, in Queensland, on the Sandwich, and other islands of the Pacific. When the *ăch* is cultivated, it is generally raised from seed, and dug up when a few years old, unless trees are wanted to produce seed. A full account of its cultivation in As. Researches, iv. 35 (1799).

Entirely distinct from this sp. are *Morinda angustifolia*, Roxb. l. c. 549; Cor. Pl. t. 237, from Bengal, Burma (cultivated in Toungyas as a dye), and Singapore, distinct drupes, and *M. umbellata*, Linn.—Syn. *M. scandens*, Roxb. l. c. 548, a diffuse or climbing shrub common in Southern and Eastern India, with 4-8 umbellate terminal peduncles.

14. HAMILTONIA, Roxb.

Shrubs with opposite, petiolate, ovate-lanceolate penniveined leaves, and short, intrapetiolar, broad, acute, persistent stipules. Flowers fasciculate, in large trichotomous panicles. Calyx-tube ovoid, limb 5-cleft, segments subulate, persistent. Corolla funnel-shaped; tube long, lobes 5, valvate. Stamens inserted in the mouth of the corolla, anthers attached by the back to short, subulate filaments. Ovary 5-celled, with 5 furrows, the dissepiments disappearing afterwards. Capsule 1-celled, 5-seeded, opening at the apex into 5 valves. Seeds triquetrous, testa of 2 layers, the outer reticulate. Cotyledons foliaceous, cordate, induplicate, radicle inferior.

1. **H. suaveolens**, Roxb. Fl. Ind. i. 554.—Syn. *H. propinqua*, Dne. in Jacq. Voy. Bot. t. 91; *Spermadictyon suaveolens*, Roxb. Cor. Pl. t. 236; *S. azureum*, Wall. Bot. Reg. t. 1235. Vern. *Muskei*, *kantālu*, *fisauni*, Chenab; *Niggi*, *tulenni phūl*, *gohinla*, Ravi; *Kanera*, *pudāri*, Bias; *Phillu*, Sutlej; *Iogia padera*, Kamaon.

A shrub, with divaricate, more or less herbaceous branches. Leaves elliptic-oblong, 6-9 in. long on short petioles, glabrous or pubescent, firm, hard and rough, main lateral nerves 10-16 pair, arcuate, anastomosing with intermediate more slender nerves. Branches of panicle pubescent. Flowers sessile or shortly pedicellate, in compact fascicles, with subulate bracts, white or blue, fragrant, calyx-segments linear or subulate, longer than ovary, clothed all over with long hairs, and often in addition with a few distant filiform gland-tipped teeth, or hairless, with glandular teeth, or clothed with short pubescence only. Corolla-tube ½ in. long, pubescent outside, anthers more or less exserted, stigma included or exserted.

A common but somewhat variable shrub, on rocky dry hills, generally only a few feet high, but attaining in places 8-12 ft. It is known from Behar, the Aravalli hills (Mairwara), and Mount Aboo, the Salt range in the Panjab, and the Himalaya from the Indus to Nepal, ascending to 5000 ft. Fl. Oct.-Dec. Wood small, but in Chamba said to be used for making gunpowder-charcoal. *H. mysorensis*, W. & A. Prodr. 423, from Mysore and Western India, fl. white, Jan.-March, is closely allied, if not the same species; the glandular-tipped teeth of calyx-segments, which are supposed to be its specific character, are found equally in specimens from Behar, North-West India, and Mairwara. Graham, Bomb. Cat. 91, asks whether they are identical, and adds they look much like each other. I am inclined to think that farther researches on the spot will show that they are not specifically distinct.

Leptodermis lanceolata, Wall.; Jacquem. Voy. Bot. t. 90.—Vern. *Padera*, Kamaon; is a small shrub with white sessile flowers in bracteate heads, forming large terminal panicles. Each flower is enclosed in a tubular 2-toothed and 2-nerved membranous involucre, composed of 2 connate cuspidate bracts, the capsule is cylindrical, 5-valved, the valves terminate in ovate, persistent ciliate calyx-lobes, and separate from 5 central fibrous, reticulate 1-seeded bags. North-West Himalaya 5000-10,500 ft.; fl. June-Aug. Leaves fetid when bruised.

ORDER XLVI. ERICACEÆ.

Shrubs, small trees or rarely wiry herbs. Leaves usually alternate, simple, exstipulate. Calyx more or less deeply divided into 4 or 5 teeth or lobes, tube adnate to the ovary (*Vaccinieæ*) or quite free (*Ericineæ*). Corolla hypogynous or epigynous, the tube ovoid, globose, tubular, or campanulate. Stamens generally double the number of corolla-lobes, hypogynous or epigynous. Anthers 2-celled, opening at the top by 2 pores or oblong slits, or rarely longitudinally. Ovary inferior or superior, usually 4-5-∞-celled, with many ovules in each cell, on axile placentas. Style slender; stigma entire or minutely lobed. Seeds very small, with a fleshy albumen; embryo straight, often minute.—Royle Ill. 255 (*Vaccinieæ*), 257; Wight Ill. ii. 116, 119.

This Order comprises two sub-Orders: 1. *Vaccinieæ*, with inferior ovary, containing the Bilberry (*Vaccinium Myrtillus*, Linn.) of Europe, and numerous species of the same genus on the mountains of Southern and Eastern India. 2. *Ericineæ*, with superior ovary, comprising the numerous heaths of Europe and South Africa, and to which sub-Order belong the two genera which find a place in this Flora.

Capsule globose, 5-celled, dehiscing loculicidally . . .	1. ANDROMEDA.
Capsule cylindrical or conical, 5-18-celled, dehiscing septicidally	2. RHODODENDRON.

1. ANDROMEDA, Linn.

Shrubs or trees with alternate, petiolate leaves. Calyx without bractlets. Sepals 5, wholly or partially distinct, valvate in the bud. Corolla 5-toothed. Stamens 10; anthers fixed near the middle, the cells opening by a terminal pore. Capsule globose, 5-celled, 5-valved, dehiscing loculicidally, dissepiments remaining on the valves. Seeds numerous, minute, linear, on thick placentæ projecting from the summit or the middle of the axis.

1. **A. ovalifolia**, Wall.; Wight Ic. t. 1199.—Syn. *Pieris ovalifolia*, Don. Vern. *Ayatta, eilan, ellan, ellal, arur, rattankāt*, Pb.; *Eyāṛ, ayār*, N.W.P.; *Anjīr, angiār*, Nepal.

A glabrous shrub or small tree. Leaves coriaceous, entire, 3-6 in. long, ovate or elliptic-oblong, acute or shortly acuminate, penniveined, on short petioles. Flowers white to bluish, flesh-coloured sometimes, in unilateral, bracteate racemes; bracts lanceolate, deciduous. Corolla tubular, slightly constricted at the mouth. Filaments subulate from a thickened base, ciliate, included, but nearly as long as corolla-tube, with two spreading ciliate filiform appendices at the apex; anthers awnless, oblong. Sutures of the capsule with a linear ridge, which pulls away separately when the capsule opens.

Common in the outer Himalaya from the Indus to Assam, usually between 4000 and 8000 ft., at times ascending to 10,000, and descending as low as 2000 ft. Kasia hills, Burma, and Japan. In oak and pine forests, and often associated with *Rhododendron arboreum*. Leafless for some time in winter, new foliage Feb. Fl. April-June; capsules ripen July-Sept. Growth slow, 34 rings per inch. Bark rough, with numerous narrow, deep, close-set cracks, tailing off into each other. Inner bark fibrous. Wood light reddish-brown, compact, firm, not durable, used only as fuel and for making charcoal. Buds and young leaves are poisonous to goats;* the young leaves are used to kill insects, an infusion and the juice of the leaves are applied externally in skin diseases.

A. formosa, Wall.; Wight Ic. t. 1200.—Syn. *Pieris formosa*, Don.; is an evergreen tree with lanceolate serrulate leaves, racemes in large terminal panicles. Bhutan, Sikkim (7000-10,000 ft.), Nepal, and (doubtfully, Madden) in Eastern Kamaon at 7000 ft.

2. RHODODENDRON, Linn.

Shrubs or trees, with evergreen, entire, alternate leaves and large showy flowers usually in compact terminal clusters or umbelliform corymbs, from large buds with scaly bracts. Calyx free, entire, 5-lobed or 5-parted, or obsolete. Corolla campanulate or infundibuliform, 5-12-lobed, sometimes slightly irregular. Stamens 10-20, commonly declinate, as well as the style; anthers short, opening by terminal pores, awnless. Ovary superior. Capsule cylindrical or conical, 5-18-celled and -valved, dehiscing septicidally. Seeds numerous, scale-like. Placentæ projecting from the axis, either 2 in each cell (the inflected and distinct edges of the carpellary leaves), bearing seeds on the outside only, or one placenta in each cell bearing seeds on both sides.

Flowers in terminal corymbs; calyx small, flattish.
  Flowers on short pedicels; capsules 10-celled, 10-valved . 1. *R. arboreum.*
  Flowers on slender pedicels ¾-1 in. long; capsules 5-6-celled 2. *R. campanulatum.*
Flowers in terminal corymbs; calyx cleft to the base; lobes foliaceous, membranous . . . . 3. *R. Anthopogon.*
Flowers solitary; calyx foliaceous . . . . 4. *R. lepidotum.*

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* See Cleghorn in Journ. Agr. Hort. Soc. of India, xiv. 260 (1867).

1. **R. arboreum,** Sm.—*Tree Rhododendron.* Vern. *Ardāwal,* Jhelam; *Mandāl,* Chenab; *Chiu, āru,* Ravi; *Brās, broa, būrāns, būrūnsh,* Bias to Sardah; *Bhorāns, gūras,* Nepal.

A small tree; leaves crowded at the ends of branches, coriaceous, elliptic-oblong, acute at both ends, rarely obtuse, 4-6 in. long, glabrous, shining above, with a dense silvery film of small scales beneath; main lateral nerves 15-25 on either side of midrib, prominent beneath, depressed on the upper surface. Flowers commonly crimson-scarlet, occasionally white pink or rose-coloured, or marked with purple or yellowish spots, 1-2 in. long, on short peduncles in sessile, dense, many-flowered terminal corymbs; buds subglobose, covered with broad tomentose scales. Calyx small, flat, persistent, with 5 spreading unequal teeth. Corolla between turbinate and campanulate, with 5 unequal lobes. Stamens alternately longer. Capsules on thick, hirsute peduncles, ¼-½ in. long, cylindrical, about 1 in. long, curved, 10-grooved, 10-celled. Seeds minute, on bipartite placentæ.

Hills trans-Indus. Common on the outer ranges of the Himalaya from the Indus to Bhutan, between 3000 and 8500 ft., ascending at times to 11,000. Does not extend into the arid parts. Often associated with *Quercus incana* and *Andromeda.* Never leafless, the foliage is renewed gradually. Time of flowering varies, the usual period is March-May; has been seen in flower during winter, with snow on the ground. Again at times the blossoms do not come out until June or July (Simla, 1849, 1867). Growth slow, 14 rings per inch. Hardy at Kew in sheltered places.

Attains 30-40 ft., with a short, often gnarled, not straight trunk, 7-8 ft. girth, specimens of 15-17 ft. have been measured, but these large stems are always hollow. Bark 1 in. thick, chestnut brown, corky, rimose, wrinkled. Wood light or dark brown, close-grained and hard, but not strong; employed for building, made into dishes, and used for fuel and charcoal. Annual rings very clear and distinct. Flower-buds and young leaves believed to be poisonous to cattle. The flowers are eaten, and made into a pleasant subacid jelly; they are at times intoxicating. They are offered in temples, and are applied for headaches.

R. nilagiricum, Zenker.—Syn. *R. arboreum,* Wight Ic. t. 1201; Bedd. Fl. Sylv. t. 228; on the Nilgiris, Pulneys, and Anamallays; is closely allied, and perhaps not specifically distinct. It has shorter and generally broader leaves, with a rusty film beneath, and a broadly tubular or campanulate corolla-tube, with a spreading, nearly flat limb. At high elevations in the N.W. Himalaya *R. arboreum* is said to have a rusty, not silvery, film beneath.

2. **R. campanulatum,** Don; Bot. Mag. t. 3759.—Vern. *Gaggar, yurmi,* Kashmir; *Sarngar, shinwala,* Ravi; *Shargar,* Bias; *Simrung,* Sutlej.

A shrub; leaves crowded at the ends of branches, coriaceous, elliptic or elliptic-oblong, 3-5 in. long, smooth, shining above, with a dense buff-coloured film beneath; midrib prominent, main lateral nerves indistinct. Flowers whitish pink or lilac, 1-1½ in. long, on slender peduncles ¾-1 in. long, in sessile terminal corymbs. Buds subglobose, covered with glabrous or pubescent scales. Calyx small, flat, persistent. Corolla campanulate. Capsules cylindrical, about 1 in. long, curved, 5-6-celled, 5-6-valved.

Himalaya 9500-14,000 ft., found in the inner more arid tracts (*e.g.*, Kunawar), as well as on elevated points of the outer ranges (Chūr, Kedar Kanta). From the Indus to Nepal. *R. Wallichii*, Hook. fil.; Rhod. Sikk. t. v.; Bot. Mag. t. 4928; from Sikkim, 11,000-13,000 ft.; is believed to be a variety of this species. Fl. May-July. The leaves (*Tamāku, hulās, patti Kasmīri*) are brought to the plains and used as snuff. Wood close-grained. Hardy in England.

3. **R. Anthopogon**, Don; Royle Ill. t. 64.—Syn. *Osmothamnus fragrans*, DC. Vern. *Nīchni*, *rattankāt*, *nera*, Jhelam; *Tazak-tsun*, *Kashmir; Kāi zabān*, *morūa*, *talīsa*, Ravi; *Talīsri*, Bias.

A small alpine shrub, with a heavy aromatic odour, young parts with glandular hairs and rust-coloured scales. Leaves approximate at ends of branchlets, 1-1½ in. long, elliptic or elliptic-oblong, shining above, ferruginous beneath, edge recurved. Flowers on short pedicels in short terminal corymbs. Calyx-lobes oblong, obtuse, membranous, ciliate. Corolla hypocrateriform, with a long slender tube, and a plain patent limb. Capsule surrounded by the persistent calyx, 5-celled, 5-valved. Style short, erect, clavate.

Himalaya, Kashmir to Sikkim, generally above the forest limit, between 11,000 and 16,000 ft. Chūr, Kedar Kanta, Kunawar. "Nothing exceeds the beauty of its flowers, whether we consider the texture of the corolla, exquisitely tender, translucent, or the rich blush of the first opening blossoms, which insensibly passes into snowy white, then faintly tinged with sulphur, all colours seen on one and the same plant."—Hook. Rhod. Sikk. p. 7. Fl. June-July. Hardy at Kew in sheltered places.

4. **R. lepidotum**, Wall.; Royle Ill. t. 64.—Vern. Names of preceding.

A small alpine shrub, aromatic, young parts with silvery or rust-coloured scales. Leaves approximate at ends of branchlets, ¾-1 in. long, oblong or obovate-oblong, acute, the under side with a silvery or brownish film, edge recurved. Flowers varying from red to dingy yellow, solitary or 2-3 together, on pedicels ½-¾ in. long. Calyx-lobes oval, obtuse, not ciliated. Corolla with a broad short tube and a patent concave limb. Style short, thick, recurved. Capsule 5-celled, 5-valved.

Himalaya, Kashmir to Sikkim, between 10,000 and 16,000 ft. Lahaul, Hattu, Kunawar, &c. The leaves of this and the preceding species (*talīsfar*, Pb.) are used as stimulants in native medicine.

ORDER XLVII. MYRSINEÆ.

Trees or shrubs, with alternate, simple, entire or toothed leaves, without stipules. Flowers small, usually pentamerous or tetramerous, in axillary clusters racemes or panicles, rarely in terminal panicles. Calyx free or rarely adhering to the ovary. Corolla regular, gamopetalous and polypetalous, rarely wanting. Stamens epipetalous, as many as petals or divisions of the corolla, and opposite to them. Ovary 1-celled, ovules numerous or few, attached to a free central placenta, which is often thick and globular. Fruit an indehiscent berry or drupe, rarely splitting lengthwise on one side. Seeds with few exceptions albuminous, often with more than one embryo.—Royle Ill. 264; Wight Ill. ii. 137.

Calyx-tube adnate to the ovary . . . . 1. Mæsa.
Calyx free; petals free to the base . . . . 2. Embelia.
Calyx free; petals united in a short tube, with a deeply-lobed limb.
  Corolla without appendages; anthers longer than short filaments.
    Flowers in dense axillary clusters . . . . 3. Myrsine.
    Flowers umbellate, corymbose, or paniculate . . . . 4. Ardisia.
  Corolla with appendages; filaments long; flowers in axillary clusters . . . . 5. Reptonia.

1. MÆSA, Forskal.

Flowers in simple or compound racemes with small bracts and two bracteoles under each flower. Calyx-tube adherent, limb 5-lobed, corolla 5-lobed. Stamens 5, filaments slender, anthers short. Ovary inferior or half-superior. Ovules numerous, more or less embedded in a fleshy placenta. Style short. Berry crowned by the persistent calyx-lobes, many-seeded.

Glabrous, racemes much longer than petiole . . . . 1. *M. indica.*
Pubescent, racemes as long as petiole . . . . . 2. *M. argentea.*

1. **M. indica,** A. DC.; Wight Ic. t. 1206.—Syn. *Bæobotrys indica,* Roxb. Fl. Ind. i. 557. Vern. *Kalsīs,* Kamaon; *Atki,* Bomb.

A large shrub, sometimes with a tendency to climb; glabrous, inflorescence only slightly pubescent. Leaves elliptic-oblong ovate-oblong or lanceolate, 3-6 in. long, on petiole ½-in. long, membranous, dentate, with large distant teeth, edge revolute. Flowers white, mostly unisexual, on slender pedicels, as long as flowers, in compound, nearly sessile, axillary racemes, the racemes of male flowers 1-2 in. long, longer than those of the female flowers; bracts shorter than pedicel. Calyx-lobes obtuse, slightly ciliate or pubescent. Anthers broad, nearly rotundate. Berry globose, white, $\frac{1}{12}$ in. across. This and other species of Mæsa are liable to a peculiar monstrosity, the flowers being replaced by dense spikelets of closely imbricated bracts, which transform the racemes into dense sterile panicles.

A common shrub in South India, Burma, and Bengal. In the sub-Himalayan tract west to the Ganges, ascending to 5000 ft. Also in Ceylon, China, the Indian Archipelago. The specimens from N.W. India certainly belong to *M. indica;* whether *M. montana,* A. DC., is a distinct species, I do not venture to decide. Fl. at different times, chiefly April-Oct.; the berries ripen in the course of three months, and are eaten in Nepal. In Canara the leaves are used to poison fish.

2. **M. argentea,** Wall. Fl. Ind., ed Carey, ii. 233.—Vern. *Phusera, gogsa,* N.W.P.

A large shrub, 6-8 ft. high; branches subscandent, clothed with soft and dense pubescence. Leaves elliptic, 6-10 in. long, dentate with sharp teeth, slightly pubescent above, white or grey-tomentose beneath, acuminate, on petiole 1 in. long. Flowers white, on short pedicels, in short compact axillary racemes as long as petiole, with a few short branches at the base. Berry round, smooth, white, size of a peppercorn. Seeds numerous, minute, immersed in the surface of the fleshy globular placenta.

Outer Himalayan ranges, Kamaon and Nepal 4000-6000 ft. Fl. April-May. Fruit July, is eaten.

2. **EMBELIA,** Burm.

Shrubs or woody climbers. Flowers small, in simple or branched slender racemes, either axillary or forming a terminal panicle. Calyx free, deeply 5-lobed. Petals 5, rarely 4, distinct, spreading. Stamens as many, inserted at the base of and not exceeding the petals; filaments filiform, anthers short. Ovary superior; style short; ovules few, embedded in a globular fleshy placenta. Fruit a dry 1-seeded berry.

Flowers in large terminal panicles; main lateral nerves of leaves numerous, indistinct . . . . 1. *E. Ribes.*
Flowers in axillary racemes; main lateral nerves 6-10 pair, prominent . . . . 2. *E. robusta.*

1. **E. Ribes**, Burm.; Roxb. Fl. Ind. i. 586.—Syn. *E. glandulifera;* Wight Ic. t. 1207. Vern. *Kārkannie*, Bomb.; *Baberung*, Silhet.

A large climbing shrub; glabrous, only branches of inflorescence densely pubescent. Leaves 2-3 in. long, coriaceous, entire, shining above, paler beneath, elliptic-oblong, acuminate, narrowed into a short marginate petiole; main lateral nerves numerous, parallel, not prominent; glands along midrib, petiole or edge of the leaf near base, or wanting. Flowers polygamous, small, pubescent, of a greenish-yellow colour, on pubescent pedicels longer than calyx, in slender racemes, forming large terminal panicles. Bracts shorter than pedicels. Calyx-lobes acute. Petals elliptic, acute. Stamens on short filaments, included. Berry the size of a peppercorn, black, succulent, wrinkled when dry; seed solitary, globose, aromatic and somewhat pungent.

Common in South India, Ceylon, Burma, Bengal, and will probably be found in the Satpura range. Also in China and the Indian Archipelago. In Silhet the berries are collected and used to adulterate black pepper (Roxb.) The berries, sold under the name of *Bebrang*, *Babarang*, *Waiwarang* in the bazaars of India as an anthelmintic, are the fruit of this species.

2. **E. robusta**, Roxb. Fl. Ind. i. 587.—Syn. *E. Tsjeriam cottam*, Wight Ic. t. 1209; *E. Basaal*, Don. Vern. *Amti*, *Ambat*, *Bārbatti*, *Byebering*, Bomb.; *Bebrang*, Oudh.

A large, spreading and scrambling shrub or small tree, very variable in appearance. Branchlets, petioles, under side of leaves, and racemes more or less rough with rust-coloured pubescence, sometimes glabrous. Leaves 2-4 in. long, membranous, entire, elliptic, short-acuminate; petioles short, terete, or channeled, but not marginate; main lateral nerves prominent, 6-12 on either side of midrib, with shorter intermediate ones, anastomosing by intramarginal veins. Flowers dioicous or polygamous, greenish white, glandular-pubescent, on pedicels longer than calyx, in axillary racemes varying in length, those of the male flowers longer, but not generally exceeding the length of leaf. Bracts subulate, shorter than pedicels. Petals oblong, reflexed. Stamens in male flowers long-exserted. Berry dry, spherical, nearly ⅛ in. diam., generally with more or less distinct longitudinal ribs.

Common in western India, Bengal, Behar, and the sub-Himalayan tract as far as the Jumna. Trunk short, erect, branchlets covered with numerous callous dots, round or linear. Fruit ripens Oct.-March.

E. villosa, Wall., Behar, leaves soft villous underneath, flower-racemes long, slender, 4-6 in. long, is closely allied to this, if specifically distinct.

3. MYRSINE, Linn.

Shrubs or small trees, with coriaceous leaves. Flowers small, on short pedicels, in dense clusters, usually from the axils of fallen leaves. Calyx 4- or 5-lobed. Corolla deeply 4- or 5-lobed. Stamens as many; anthers erect, ovate or lanceolate, on very short filaments. Ovary free, style short.

Small trees, wholly glabrous; fruit clustered.
  Leaves serrate; main lateral nerves few . . . . . 1. *M. semiserrata.*
  Leaves entire; main lateral nerves numerous, indistinct . 2. *M. capitellata.*
A shrub, branchlets pubescent; fruit solitary . . . . . 3. *M. africana.*

1. **M. semiserrata**, Wall.; Fl. Ind. ed. Carey, ii. 293; Tent. Fl. Nep. t. 24.—Vern. *Parwana*, *kūngkūng*, *gogsa*, *bamora*, *gaunta*, N.W.P.; *Bilsi*, *beresi*, *kalikatha*, Nepal. (*M. acuminata;* Vern. *Chūpra*, Kamaon, Madden Journ. As. Soc. xvii. i. 368, is probably the same species).

A small or middle-sized tree, glabrous, with resinous leaf-buds. Leaves coriaceous, lanceolate, 3-5 in. long, narrowed into a short petiole, entire or sharply serrate from the middle to the apex, sprinkled with numerous resinous pellucid dots, edge revolute, midrib prominent beneath; main lateral nerves anastomosing by prominent reticulate and intramarginal veins. Flowers small, scentless, tetrandrous or pentandrous, polygamous, white, with a light pink tinge, on short pedicels in numerous axillary rounded fascicles, with small, ovate deciduous brownish scales at the base. Calyx persistent. Corolla-tube very short, lobes more than twice the length of calyx, oblong, recurved. All parts of the flower with resinous dots. Anthers ovate exserted. Ovules 3-4, semi-immersed in a horizontal line round the globose fleshy free placenta. Style short, with a fleshy stigma, expanding from a tubular base into a large unilateral, 3-lobed fimbriated limb. Drupe the size of a pea, red, globose, a little depressed, smooth and shining; exocarp soft, fleshy, endocarp crustaceous. Seed one, globose. Embryo cylindric, slightly curved, surrounded by a cartilaginous albumen, slightly ruminated and pitted on the outside.

Outer Himalayan ranges, 3000-9000 ft., from the Bias to Bhutan. Fl. and fr. Dec.-March. In favourable places attains 30-40 ft. Bark ash-coloured, often dark, nearly black, longitudinally wrinkled, with many prominent, callous dots. The fruit is eaten. Wallich states that the wood is chocolate-coloured, compact, heavy hard handsome and much esteemed in Nepal for carpenter's work.

2. **M. capitellata**, Wall.; Fl. Ind., ed. Carey, ii. 295; Tent. Fl. Nep. t. 25; Wight Ic. t. 1211; Bedd. Fl. Sylv. t. 234.

A small or moderate-sized glabrous tree. Leaves coriaceous, lanceolate elliptic- or obovate-oblong, 3-7 in. long, gradually narrowed into a short, marginate petiole, entire, with resinous dots near the edge, midrib prominent, lateral nerves numerous, slender, parallel, indistinct. Flowers polygamous, greenish, with copious minute, elevated, resinous, brown dots; on short pedicels, in lateral rounded heads, sessile, or on short woody peduncles, axillary, or on the previous year's wood. Calyx small, persistent. Corolla-tube short, lobes oblong, recurved. Anthers oval, partly exserted. Stigma blunt or 2-lobed. Drupe globose, $\frac{1}{8}$ in. diam.

Mountains of South-Western India and Ceylon, Burma, and Eastern Bengal. Nepal. Fl. and fr. Dec.-March. The fruit is eaten; wood similar to that of *M. semiserrata*.

3. **M. africana**, Linn.—Syn. *M. bifaria*, Wall. Vern. *Shamshād*, Afg.; *Bebrang*, *kakhum*, *kokhūri*, *karuk*, *gūgul*, *jutru*, *chachri*, *prātshu*, *branchu*, *khūshin*, *pāpri*, *bandāru*, *bīnsīn*, *atūlgān*, Pb.; *Guvaini*, *pahāri cha* (hill tea), *chūpra*, N.W.P.

A shrub; branchlets, petioles, and lower part of midrib pubescent with short, ferruginous hairs. Leaves bifarious, coriaceous, lanceolate or obovate, narrowed into a very short petiole, $\frac{1}{2}$-1 in. long, sharply serrate, the serratures cuspidate, midrib prominent; main lateral nerves few, inconspicuous, anastomosing by reticulate veins. Flowers small, white, with a pale pink tint, dotted with brown resinous dots, male and bisexual, tetrandrous, nearly sessile, in axillary fascicles of 4-6. Anthers oblong, purple, twice the length of the corolla. Style short; stigma large, flat, verrucose. Drupes solitary, globose, red, smooth, $\frac{1}{10}$ in. diam.

Common in N.E. Afghanistan and the hills trans-Indus, in the Salt range, and the outer Himalaya from 2500 to 8500 ft., extending eastward into Nepal. Abyssinia, Cape of Good Hope. Fl. March-May; fr. Jan.-Nov. Attains 20 ft., branching from the ground. Bark grey, with numerous elevated specks, and shallow longitudinal wrinkles, occasionally a whitish pellicle peeling off. Well worth trying for garden-hedges. The wood is used for fuel; the fruit is sold in the bazaars of North-West India under the name of *Bebrang*.

4. ARDISIA, Linn.

Trees shrubs or undershrubs. Flowers larger than in other *Myrsinaceæ*, in umbels or short corymbs, axillary or terminal, solitary, or forming branched panicles. Calyx free, 5-lobed. Corolla deeply 5-lobed, lobes spreading or reflexed, convolute in bud, tube very short. Stamens 5; filaments short; anthers erect, lanceolate, appendiculate at the top; base emarginate or bifid. Ovary 1-celled; style subulate, usually long and persistent, the stigma not enlarged; ovules generally 6-12. Fruit fleshy, globose, 1-seeded.

Flowers in axillary corymbs shorter than leaf . . 1. *A. humilis*.
Flowers in terminal panicles . . . . . . 2. *A. floribunda*.

1. **A. humilis**, Vahl; Wight Ic. t. 1212.—Syn. *A. solanacea*, Roxb. Corom. t. 27; Fl. Ind. i. 580. Vern. *Kantena*, *maya rawa*, C. Prov.

A large shrub, wholly glabrous. Leaves 4-8 in. long, obovate-oblong, narrowed into a short marginate petiole, entire, short-acuminate; midrib prominent, main lateral nerves numerous, oblique, arcuate, parallel, not very conspicuous. Flowers light rose-coloured, ½ in. across, in pedunculate, axillary corymbose racemes, shorter than leaves. Pedicels ½ in. long, longer in fruit, red, in the axils of oblong or rounded concave, deciduous bracts. Calyx nearly to the base 5-cleft, lobes oval or rounded, obtuse. Berry size of a small cherry, round, black, 1-seeded, full of bright-red juice.

South India and Ceylon. Burma. Bengal. Sub-Himalayan tract as far west as the Jumna, ascending to 3000 ft. Generally on banks of streams and in moist places. Indian Archipelago, South China. Fl. at all seasons, principally March-May. Bark yellowish grey or brownish. Wood used as fuel.

2. **A. floribunda**, Wall.; Fl. Ind., ed. Carey, ii. 272.

A shrub or small tree, young shoots, tender leaves, and inflorescence clothed with short, loose, purple pubescence, full-grown leaves glabrous. Leaves pale beneath, narrowly oblong-lanceolate, 5-6 in. long, shallow and indistinctly crenulate, narrowed into a marginate petiole ½ in. long; midrib prominent, lateral nerves indistinct. Flowers small, red, on short coloured pedicels, thickened at the top, in terminal compound ovate panicles, with linear bracts, the lower branches in the axils of leaves, and often leaf-bearing. Calyx almost white, lobes spreading, ovate, acute. Corolla rotate. Anthers bursting from the middle to the apex, terminated by a subulate appendix.

Outer Himalaya to 5000 ft. Garhwal, Kamaon, Nepal, Sikkim, Assam, Kasia hills.

5. REPTONIA, A. DC.

Evergreen shrubs with entire coriaceous leaves, and small flowers. Calyx 5-lobed. Corolla with a short tube, and 5 spreading lobes, convolute in the bud, with 5 small scales alternating with the lobes, and inserted in the mouth of the tube. Ovary superior, 1-celled; ovules 1-4 on a small placenta at the bottom of the ovary. Drupe globose, seed albuminous.

1. **R. buxifolia**, A. DC.—**Tab. XXXIV.**—Syn. *Monotheca Muscatensis*, A. DC.; *Edgeworthia buxifolia*, Falc.; Trans. Linn. Soc. xix. t. 9. Vern. *Garar*, Afg.; *Gūrgūra*, Pb.

A large shrub or small tree, with axillary spines and spinescent branchlets; young branches and leaves pubescent. Leaves 1-1½ in. long, obovate oblong-obovate, or oblong-elliptic, thick, coriaceous, with thickened edge, narrowed into a short petiole; when full-grown shining above, glaucescent and puberulous beneath. Flowers whitish, or greenish yellow, nearly sessile, in dense axillary clusters with minute, ovate, scaly persistent bracts. Calyx rusty tomentose, lobes ovate, obtuse, imbricate in bud. Stamens inserted on the corolla-tube; anthers short lanceolate, on long exserted slender filaments. Ovary hairy, with long subulate style, exserted in the bud; ovules 5. Drupe sessile, globose, supported by the persistent base of calyx, ⅓ in. diam. or more, glabrous, greenish, with a fleshy sweet pericarp in a coriaceous rind. Seeds 1, globose, or 2 hemispherical; testa smooth, osseous, albumen white, cartilaginous, deeply ruminate. Embryo arcuate.

Common in the western part of the Panjab Salt range, and abundant on the hills trans-Indus from Peshawar to Dera Ishmael Khan, ascending to 4700 ft. According to Griffith common in Eastern Afghanistan. Also in Arabia. One of the characteristic plants of the trans-Indus territory, growing mostly on dry rocky hills. Evergreen; fl. Feb.-April; fr. May and onward, often remaining long on the branches. Attains 15-20 ft., often with a short straight trunk attaining girth of 2-3 ft., with numerous spreading divergent branches, forming a close rounded head. Young shoots clothed with delicate pubescence, bark of stem ash-coloured or blackish, tesselated into small irregularly quadrangular pieces by deep longitudinal and transverse furrows and cracks, resembling that of *Fraxinus Moorcroftiana.* Wood beautifully variegated, light brown and whitish, with slender medullary rays, and indistinct annual layers, compact, even-grained, hard and strong. The fruit is much esteemed, and during the season is sold in most bazaars; the pulp is sweet, but there is not much of it. The hard seed is uneatable, it is strung in rosaries.

ORDER XLVIII. SAPOTACEÆ.

Trees or shrubs, frequently with milky juice. Leaves alternate, entire, usually coriaceous, without stipules. Calyx free, lobes 4 - 8. Corolla hypogynous, regular, divided into the same number of lobes, or a larger number in 2 or 3 series. Stamens inserted on the corolla-tube, as many as corolla-lobes, or as the lobes of the inner circle, and opposite to them, or numerous. Staminodes often alternating with the fertile stamens, or with the divisions of the corolla. Ovary superior, 2 or more-celled, 1 ovule in each cell; style simple, stigma entire or slightly lobed. Fruit a berry or drupe, usually indehiscent. Seeds either with a fleshy albumen and foliaceous cotyledons, or without albumen and with fleshy cotyledons. Testa hard, generally shining.—Royle Ill. 262; Wight Ill. ii. 142.

Leaves with prominent lateral nerves. Corolla campanulate or ovoid; limb with 5-14 lobes. Stamens 20-40 without staminodes. Seeds without albumen	1. BASSIA.
Leaves with numerous fine parallel veins. Corolla rotate; limb with 15-24 lobes in 2 rows. Stamens 5-8, alternating with staminodes. Seeds albuminous	2. MIMUSOPS.

Isonandra Gutta, Hook. Journ. Bot. vi. (1847), t. 16, the tree which yields the gutta-percha of commerce, has 6 corolla-segments, 12 stamens without staminodes and penniveined leaves. Singapore, Borneo, and other islands of the Indian Archipelago.

Achras Sapota, Linn. (*Sapota Achras,* Mill.), is a large tree with reddish-brown, hard, heavy and very durable wood (Bullet or Bully wood) from Central America and the West Indies, which produces the *Sapota*, one of the most pleasant fruits known, when completely ripe; is grown in gardens in Bengal, and as far north as Saharanpur.

1. BASSIA, Kœnig.

Trees, with milky juice. Flowers on axillary, generally fasciculate pedicels. Calyx divided nearly to the base into 4-8 biseriate lobes, the outer lobes subvalvate, the inner subimbricate in bud. Corolla ovoid or campanulate, limb of 5-14 divisions. Stamens numerous, or twice or thrice as many as lobes of the corolla, all fertile, in 1-3 series; anthers erect, lanceolate from a cordate base, cuspidate or aristate, 2-celled; cells distinct, dehiscing longitudinally. Ovary hirsute, 4-8-celled; style simple, long exserted. Fruit an oblong or globose berry, 1-4-seeded. Seeds oblong, exalbuminous, with a shining crustaceous testa. Cotyledons oblong-elliptic, fleshy, filled with oil, radicle inferior.

Corolla-tube fleshy; lobes erect; anthers 22-30, sessile . . . 1. *B. latifolia.*
Corolla-tube not fleshy; lobes spreading; anthers 30-40, on long filaments . . . . 2. *B. butyracea.*

1. **B. latifolia,** Roxb. Cor. Pl. t. 19; Fl. Ind. ii. 526; Bedd. Fl. Sylv. t. 41.—Sans. *Madhūka.* Vern. *Mahwa*, *mahūa*, *mohwa.* Local names: *Irūp mara,* Gondi.

A large tree; young branches, young leaves, pedicels and petiole pubescent or tomentose. Leaves coriaceous, firm, hard, clustered near ends of branches, elliptic or oblong-elliptic, 5-6 in. long, short-acuminate, on petioles 1-1½ in. long; main lateral nerves 10-12 pair. Stipules subulate, ⅓ or ½ the length of petioles. Flowers numerous, near the ends of branches below the terminal leaf-bud, drooping, on pedicels 1-1½ in. long. Calyx coriaceous, densely clothed with rusty tomentum; sepals 4-5, ovate. Corolla cream-coloured; tube ovoid, fleshy, limb with 7-14, often 8 or 9, short erect ovate teeth. Stamens 20-30, generally 24 or 26; anthers hispid at the back with stiff hairs, sessile, inserted in three series on the inside of the corolla-tube, the upper series near the mouth. Fruit green, fleshy, ovoid, 1-2 in. long, seeds 1-4.

Cultivated, propagating itself by self-sown seedlings, and protected in most parts of India. In the Panjab, it is grown in the sub-Himalayan tract and the outer valleys as far as the Ravi, but not commonly in the plains. Abundant in all parts of Central India from Guzerat to Behar. There seems no doubt that the tree is indigenous in the forests of the Satpura range, of Western India above Ghat, and perhaps also of eastern Kamaon. Thrives in dry stony ground. The old leaves are shed gradually from Feb. to April, the fresh leaves opening out immediately afterwards. The flowers generally appear before the new leaves, in March and April; and after the corollas have dropped, the leaf-buds above the flowers expand. Fruit ripens June, July.

Attains 40-60 ft., with a short trunk 6-7 ft. girth, and numerous spreading branches, forming a close, shady, rounded crown. Bark 1-2 in. thick, grey, brown or blackish, with shallow wrinkles and cracks. Inner bark red, milky.

Sapwood large, reddish white, heartwood reddish brown, close- and even-grained. Seasons well, is strong tough and durable. The cub. ft. of seasoned heartwood weighs 63 (Fowke), 66 (Skinner), 68.5 (Cunningham, Gwalior). R. Thompson gives it 52.8 (heartwood ?). Unseasoned, 78-81 lb. Value of P., 715 (Cunningham), 760 (Skinner). Not much used, as the tree is not generally felled. Has been used for railway-sleepers in the Cent. Prov. A gum exudes from cracks and incisions in the bark.

The succulent flowers fall by night in large quantities from the tree, and are gathered early in the morning; they have a sickly sweet taste and smell. They are dried in the sun, sold in the bazaar, and form an important article of food in many parts of India. They are eaten raw or cooked, often with parched grain, and put in sweetmeats. Coarse and strong spirit is distilled from them. The ripe and unripe fruit is eaten. From the seeds a greenish-yellow oil is expressed, which has at first the consistence of common oil, is eaten by Gonds and other tribes of the Satpura range, and is used to adulterate ghee (clarified butter). In a cold climate the oil keeps good a long time, but in the plains of India it gets a bitter taste and rancid smell after a few months' exposure to the air, separating into a heavy brown mass below, and a little clear fluid above. The oilcake is used to poison fish, and the smoke from burning it is said to kill insects and rats. It is also used as an emetic.

2. **B. butyracea**, Roxb.—**Tab. XXXV.**—As. Res. viii. 499; Roxb. Fl. Ind. ii. 527.—Vern. *Chiūra*, *Chaiūra*, Kamaon; *Cheuli*, Oudh. (The butter is called *Chaiūra ka pina* in Kamaon, and *phulel*, *phulwa*, *phalwara*, in the plains.)

A large tree; branchlets, petioles, pedicels and under side of leaves with soft floccose tomentum. Leaves coriaceous, clustered near ends of branches, obovate or obovate-oblong, 6-12 in. long, on petioles 1 in. long; main lateral nerves 15-20 pair. Stipules minute, caducous. Flowers numerous, near the ends of branches, below a tuft of leaves or in the axils of the lower leaves, drooping, on pedicels 1-1½ in. long. Calyx coriaceous, densely clothed with rusty tomentum; sepals 5, ovate. Corolla pale yellow, tube cylindric, not fleshy, as long as calyx, limb of 8 spreading, oblong obtuse divisions, as long as tube. Stamens 30-40, glabrous, inserted in the mouth of the tube, filaments as long as anthers. Berry ovoid, smooth, fleshy, 1-3-seeded.

Sub-Himalayan tract and outer Himalayan ranges, 1500-4500 ft., Kamaon to Bhutan. Sparse (as a small tree) in the hill forests of the Gonda division of the Oudh forests. Attains 40-50 ft., with a short, straight trunk 5-6 ft. girth. Fl. Nov.-Jan.; in Kamaon bees are believed to make excellent honey from the flowers (Madden). Bark ½ in. thick, dark grey, brownish or blackish.

The sweet, insipid pulp of the fruit is eaten. From the seeds a soft solid vegetable butter is extracted, of the consistence of fine lard, and of a delicate white colour, which does not melt in the heat of the plains, and keeps a long time without deteriorating. It melts completely at 120° F. Perfumed with cloves or attar of roses, it is used as ointment, and is held in high esteem as an external application in rheumatic and other painful affections (Pharm. Ind. 131). The cake left after the oil has been extracted is eaten. The flowers are not eaten.

Bassia longifolia, Willd.; Roxb. Fl. Ind. ii. 523; Vern. *Ippi*, *ippe*, *illupi*; is a common and most useful tree in the forests of western Mysore, Malabar, the

Anamallays, and the Circars, with lanceolate leaves. The flowers are dried, roasted, and eaten, and oil is pressed from the seeds.

The seeds of *Bassia Parkii*, Don., of tropical West Africa, yield the Shea butter, used as food and for burning, and described by Mungo Park.

2. MIMUSOPS, Linn.

Trees or shrubs; leaves with prominent midrib, and numerous fine parallel lateral veins. Flowers axillary, on recurved pedicels. Calyx-segments 6-10, in 2 series. Corolla rotate, lobes 3 times or rarely twice as many as calyx-segments, generally in 2 rows. Stamens 6-10, inserted opposite the inner corolla-lobes, and alternating with bifid or laciniate staminodia; anthers lanceolate, extrorse; filaments attached to the back of a broad connective. Ovary 6-8-celled, ovules attached near the base. Seeds more or less compressed, testa hard and shining; albumen copious, cotyledons broad and flat.

Leaves obovate-oblong, obtuse or emarginate; staminodes bifid, glabrous	1. *M. indica.*
Leaves elliptic, obtuse; staminodes irregularly jagged, glabrous	2. *M. Roxburghiana.*
Leaves elliptic, short-acuminate; staminodes lanceolate, densely hairy outside	3. *M. Elengi.*

1. **M. indica,** A. DC.; Prodr. viii. 205; Wight Ic. 1587.—Syn. *M. Kauki*, Wall. Cat. 4149 (not Linn.); *M. hexandra*, Roxb. of Bedd. Fl. Sylv. p. 141, and probably also of Roxb. Cor. Pl. t. 15, and Fl. Ind. ii. 238. Vern. *Khīr, khirni, kirni*, Hind.; *Rain*, Bassi, Meywar; *Palla*, Tam. and Telugu.

A large evergreen tree. Leaves coriaceous, shining, wholly glabrous, sometimes approximate near ends of branches, blade 2-4 in. long, obovate-oblong obtuse or emarginate, petiole ½-1 in. long. Flowers whitish, ½ in. across, in axillary fascicles of 3-6 flowers, peduncles shorter than petioles. Calyx-segments 6, ovate, acute, shortly tomentose outside, edges hairy. Corolla of two circles, the inner consisting of 6-8 oblanceolate segments, narrowed into a short claw, and alternating with 6-8 pairs of linear, sub-coriaceous acute segments of the same length, forming the outer circle. Stamens 6-8, exceeding half the length of corolla-segments, opposite to the lobes of the inner circle, alternating with an equal number of flat, bifid, more or less denticulate staminodia, which are as long as, or a little shorter than the filaments. Fruit a yellow berry, generally 1-seeded, size and shape of an olive.

Indigenous in the forests of South India and Ceylon, of Central India (Banda, Edgew.), and Guzerat. Commonly cultivated near villages in many parts of India, as far west as Multan, Lahore, and Gujranwalla. Fl. Nov.-Dec. In North India attains 50-60 ft., with an erect trunk. Bark dark grey or blackish, rough. Numerous rigid, spreading branches, forming a large shady head. Wood reddish-brown, heavy, hard and tough, close- and even-grained; used for sugar-mill beams, oil-presses, house-posts; it is an excellent wood for turning. Weight 70 lb. Value of P. 944 (Skinner; *Palla-wood, M. hexandra*). The fruit is eaten.

The naming of this well-known tree has been a matter of considerable difficulty. Linnæus in his Flora Zeylanica (1747), p. 57, describes two species: *M. Elengi* (foliis alternis remotis), regarding which there is no doubt; and another, subsequently, in Sp. Plant., called by him *M. Kauki* (foliis confertis). These species were based upon specimens collected in Ceylon by Paul Hermann, Professor of Botany at Leyden, between 1670 and 1677, and now preserved in the British Museum. Robert Brown (Prodr. Fl. Novæ Holl. 1810, p. 531) identifies with *M. Kauki* an Australian tree, which had been found by Solander in 1770 on islands off Cape Fear in Queensland. Grisebach (West Ind. Fl. 1864, p. 400) adheres to this view, and defines the area of the species as "Pacific islands, tropical Australia, and the East Indies on the sea-shore." He also refers to it a tree cultivated in the West Indies, and figured by Sir Wm. Hooker in Bot. Mag. t. 3157, under the name of *M. dissecta.* Bentham, however (Fl. Austr. iv. 285), considers that Hermann's Cingalese specimen differs from the Australian plant, which he calls *M. Browniana,* and that it should be referred to *M. indica,* A. DC., a tree, with extremely hard strong and very durable timber, which is common in the hot, drier parts of Ceylon (Thwaites Enum. 175). I have also examined Hermann's specimen, and though I do not venture to offer any opinion regarding its identity with the tree from Australia and the Indian Archipelago, I have no hesitation in saying that it cannot be referred to the North Indian tree. The leaves are obovate, acute, and the petiole more than one-half the length of the blade. They are pale beneath, though not in so marked a manner as the leaves of the tree from Australia and the Indian Archipelago; but it must be remembered that the specimen is 200 years old. It is in bud, too young for a satisfactory examination of the parts of the flower. The North Indian tree has concolor leaves, which are obovate-oblong, obtuse or emarginate, with a petiole about ¼ the length of leaf. The figure of Rumph. Herb. Amb. iii. t. 8, quoted in Linn. Spec. Plant., does not prove anything either way; and under these circumstances I do not feel warranted in adopting the Linnæan name for our tree. The Linn. Herb. at the Linnæan Society contains two specimens of *Mimusops*: one is *M. Elengi,* though marked *Kauki,* König, in Linnæus' handwriting (apparently by way of indicating the origin of the specimen), but *Elengi* in pencil by Sir J. E. Smith; the other is very incomplete, and may be a large-leaved form of *M. Elengi,* it certainly is not *Khirni.* It is marked *M. Elengi* in Linnæus' handwriting, and *M. Kauki?* in that of Sir J. E. Smith in pencil. Roxburgh's *M. hexandra* is supported by t. 15 of the Coromandel plants, and by a type specimen, in leaf only, in the Wallichian herbarium. This specimen apparently belongs to the tree under discussion, and Roxburgh's description also is evidently intended for it. But as pointed out in DC. Prodr. viii. 204, and in Wight's Ill. ii. p. 144, the staminodes are not correctly represented in the plate; and it is possible, as Wight suggests, that the flowering branch and fruit was taken from one species (*M. indica*), and the magnified flower from the other (*M. Roxburghiana*). Roxburgh's name, therefore, cannot be admitted. It is, moreover, inappropriate, as the tree has both hexandrous and octandrous flowers. Nothing therefore remains but to fall back upon De Candolle's name, *M. indica,* which is supported by good descriptions and the plate in Wight's Icones. The specimens of the tree from South and North India are identical, though there is a certain amount of variation in the shape of the staminodes, which, however, in all Indian specimens examined by me, and in some of the Ceylon specimens, are bifid. There are, however, Ceylon specimens with entire, not bifid staminodes, longer than stamens, which may possibly belong to a different species.

S. Kurz, in his Report on the Vegetation of the Andamans, and in Journ. As. Soc. xl. 1871, p. 70, calls the Andaman *Bullet-wood, M. indica.* The Martaban tree, which is (probably) erroneously quoted by De Candolle under this species, may very likely be identical with the Andaman Bullet-wood, but the Hindustan tree, as described by De Candolle and figured by Wight, is certainly different; for Kurz describes the Bullet-wood with solitary flowers, the fruit depressed-globular, 5-6-seeded, and not unlike in shape and size to a wood-apple. The *Bullet-wood* (*Kuppali*, Burm.) is a large tree, attaining a girth of 14 ft., with a tall straight stem, 60 ft. clear, which forms nearly pure forests on the level lands along the coast of those islands behind the beach, and the Mangrove swamps. The heartwood is dark reddish-brown, very strong, close-grained and durable, but apt to split. A large series of experiments which I made with this beautiful wood at Calcutta in 1864 gave the following results: Weight of cub. ft. between 66 and 71 lb., average 67.9 lb. Value of P. between 748 and 1091, average 895. Skinner describes, under the name of *M. indica* (*Pūlawa*, Tam.), another, but much lighter wood, believed to have come from the jungles about Tinnevelli, and used for gun-stocks in Madras, weight 48 lb., value of P. 845. I doubt, however, whether this is a sp. of *Mimusops*.

In conclusion, I may add that the Australian and Indian Archipelago tree (*M. Kauki*, R. Br., *Browniana*, Benth.), with long-petioled obovate leaves, grey beneath (soft with fine densely matted scales or hairs), and large ovoid fruit, 1-2 in. long, has been long cultivated in Calcutta. Roxburgh describes (Fl. Ind. ii. 238) and figures it (Ill. in Hb. Kew., 2480) under the name of *M. Kauki* (*Buasow*, Malay), and it is mentioned from Goa in Dalz. & Gibson Bomb. Fl. Suppl. 50. In Java it is cultivated on account of the fruit, which is eaten, and it appears probable that the tree was cultivated in Ceylon, so that if Hermann's specimens should belong to it, they may have been gathered from a garden-tree.

2. **M. Roxburghiana**, Wight Ic. t. 1588.

A large tree, differing from the preceding by elliptic leaves, larger flowers on slender pedicels 1 in. long, calyx-segments ovate-oblong, acute, staminodes irregularly jagged, stamens half the length of corolla-segments. Fruit depressed-globose, about 6-seeded.

Nilgiris, Anamallays, and other forests on the west side of the Peninsula.

3. **M. Elengi**, Linn.; Roxb. Cor. Pl. t. 14; Fl. Ind. ii. 236; Wight Ic. t. 1586; Bedd. Fl. Sylv. t. 40. Sans. *Vakula*, *kesara*. Vern. *Bukal*, Beng., Mahr.; *Mulsāri*, *Maulsāri*, Hindi; *Barsoli*, Bassi, Meywar; *Khayaben*, Burm.

A large evergreen tree, glabrous; only youngest leaves, pedicels and outside of calyx with short rusty pubescence. Leaves coriaceous, shining, wholly glabrous when full-grown, blade about 4 in. long, elliptic, short-acuminate, on petiole ½-¾ in. long. Flowers pure white, fragrant, nearly 1 in. across, in axillary fascicles of 2-6 flowers, drooping, on peduncles shorter than, or as long as petiole. Calyx-segments 8, ovate-lanceolate, acuminate. Corolla of 2 circles of lobes, the inner consisting of 8-10 obovate-oblong segments, narrowed at base, alternating with twice their number of linear-oblong lobes of the outer circle, all lobes more or less dentate near the apex. Stamens 8, opposite to the lobes of the inner circle; anthers long-acuminate, alternating with an equal number of lanceolate staminodes, which are shorter than stamens, and densely hirsute on the back with long stiff hairs. Fruit a smooth, ovoid, 1-seeded berry, yellow when ripe, about 1 in. long.

Indigenous in the forests of the Northern Circars, Ceylon, and the western

Ghats, as far north as Kandalla (Graham, 106). Cultivated throughout India and Burma, extending north-west as far as Delhi, Lahore, and Multan. Fl. March-April. Attains 40-50 ft., with a short trunk, wood reddish-brown, close- and even-grained, weight 61 lb. Value of P. 632 (Skinner). The tree is cultivated on account of its fragrant star-shaped flowers, which are used for garlands. The fruit is eaten, and oil is expressed from the seeds. The bark is used medicinally (Pharm. Ind. 131).

ORDER XLIX. **EBENACEÆ.**

Trees or shrubs, with entire, alternate, rarely subopposite leaves on short petioles, without stipules. Flowers axillary, or from the old wood, regular, usually dioicous, the female flowers often solitary, the male flowers in clusters or small cymes. Calyx free, 3-5-lobed, rarely with 6 or 7 lobes. Corolla hypogynous, lobes as many as those of the calyx, usually contorted in the bud. Male flowers: stamens inserted on the torus, or on the corolla-tube, generally near its base, number indefinite, or twice or four times the number of calyx-lobes. Anthers erect, linear or lanceolate, 2-celled, dehiscing at the sides longitudinally, connective usually prolonged beyond the anthers. Female flowers with or without staminodes. Ovary free, 3- or more celled, with 1 or 2 pendulous ovules in each cell. Styles 1-5, distinct or connate at the base. Fruit a berry, usually indehiscent. Seeds few, albuminous, radicle superior, cotyledons foliaceous.—Royle Ill. 261; Wight Ill. ii. 145; W. P. Hiern, A Monograph of Ebenaceæ in Cambridge Philos. Soc. Trans. xii., 1873.

1. **DIOSPYROS**, Linn.

Flowers dioicous. Calyx 3-7-lobed, usually 4-5-lobed, persistent and generally enlarged in fruit. Ovary 4-16-celled, generally with 1 ovule in each cell. Fruit generally pulpy, with 1-10 seeds. Albumen cartilaginous, white and uniform, or more or less ruminated on the outside.

Leaves often opposite; albumen ruminated . . .	1. *D. Melanoxylon.*
Leaves always alternate; albumen uniform; stamens 16.	
Pubescent or tomentose; male flowers in short pedunculate cymes	2. *D. montana.*
Pubescent or tomentose; male flowers in sessile compact fascicles	3. *D. Chloroxylon.*
Nearly glabrous; male flowers sessile, 2-3 together .	4. *D. Lotus.*
Leaves always alternate; albumen uniform; stamens 40; leaves oblong, coriaceous shining, evergreen; flowers large	5. *D. Embryopteris.*

1. **D. Melanoxylon**, Roxb. Cor. Pl. t. 46; Fl. Ind. ii. 530.—Sans. *Kendu, tinduka.* Vern. *Tend, Tendu, taindu, kendu, temru, abnūs,* (the heartwood). Local names: *Tūmrī marra,* Gondi; *Timburni,* Mar.

A middle-sized tree, branchlets, young leaves, inflorescence clothed with soft grey or tawny tomentum. Leaves mostly subopposite, coriaceous, 3-6 in. long, but sometimes much longer, to 12 in. long, when full-grown glabrous above, tomentose or pubescent beneath; main lateral nerves 6-8 pair, often irregular and branching. Petioles ¼-½ in. long. Male flowers tetramerous, sessile or nearly sessile, in short pedunculate 3-12-flowered, often drooping axillary or extra-axillary cymes, bracts subulate, as well as calyx and corolla densely tomentose. Stamens included, 12-16, free, inserted in 1 circle on the torus. Female flowers solitary, axillary or extra-axillary, generally 2, opposite to each other, larger than male flowers, subsessile, or on short thick peduncles. Calyx-lobes 4 or 5. Corolla somewhat less than twice the length of calyx, divided at the top into 4-5 short, cordate, acute or shortly acuminate lobes. Staminodes 8-10 or fewer, sometimes connate in pairs, at the base or higher up. Styles 2 or 3, bifid, ovary densely hairy, 4-8-celled, 1 ovule in each cell. Fruit yellow when ripe, ovoid or globose, 1-1½ in. across, supported by the flat spreading calyx-lobes, with undulating, often reflexed edges. Pulp yellow, soft, sweet, slightly astringent. Seeds 4-8, compressed, oblong, the back curved, shining, brown, often marked with bands across. Albumen ruminated.

Under this species I unite *D. Tupru*, Buchanan; Hiern, Ebenaceæ, 158; and *D. Melanoxylon*, Roxb. ibid. 159, comprising *D. exsculpta*, Hamilton in Trans. Linn. Soc. xv. 110 (*D. Tupru*, ib. 111), which is described with 3-4-flowered male peduncles, female flowers 4-5-merous, with 6 staminodia; *D. tomentosa*, Roxb. Fl. Ind. ii. 532, Wight Ic. t. 182, 183 (*D. exsculpta*, Bedd. Fl. Sylv. t. 66), with 3-flowered male peduncles, female flowers pentamerous, without staminodia. Whether *D. Wightiana*, Wall.; Bedd. Fl. Sylv. t. 67, should also be referred here as done by Hiern (under *Melanoxylon*), I do not venture to decide. The figure shows numerous male flowers, pentamerous female flowers with a 5-winged calyx and 10 staminodia.

Common in the dry deciduous forests of the plains and lower hills, excepting the arid region and the northern part of the Panjab. In the sub-Himalayan tract the Ravi is its north-western limit. In Rajputana I have not found it north-east of Humirgarh on the Bunass river. The leaves are shed in March-April, about the time that the fruit ripens; they are renewed soon afterwards, the flowers appearing with the young leaves. Coppices well, throws out root-suckers, and is very tenacious, so that it often is the last of the forest-trees which disappear on land cleared for cultivation (R. Thompson). Attains 30-50 ft., and 6 ft. girth. Bark ½ in. thick or more, dark grey, or blackish, rough, with numerous transverse and longitudinal cracks and furrows, exfoliating in oblong scales. Inner bark red. Wood whitish, with a red tinge, tough and fairly durable, used for building, shoulder-poles, and shafts of carriages. The centre of old trees generally consists of an irregularly-shaped mass of jet-black ebony (*abnūs, batti*), larger or smaller according to the age of the tree and other circumstances, and often with irregular projections. Trees, before felling, are generally tested by boring into the wood to see whether the ebony in the centre is sufficiently large. In large trees the ebony often attains a diam. of 12-18 in. According to the experiments available, the specific gravity of the ebony produced by this tree fluctuates between 1.080 (Fowke), and 1.362 (Centr. Prov. List). On an average it may be said that the cub. ft. weighs 75 to 80 lb. The value of P. has been found 1180 (Skinner), 862 (Cunningham, Gwalior wood), and 756 (Fowke). Kyd and R. Thompson found the weight of (probably) the outer wood 49.5 and 49.6 per cub. ft., and from Kyd's experiments the value of P. of this wood appears to be 547. The fruit is eatable, has a pleasant taste, and affords an agreeable refreshment during the hot season in the dry leafless forests of the Satpura range. Forsyth (Highlands of Central India, 463) mentions a cultivated variety without stones.

The best Indian ebony is the produce of *D. Ebenum*, Kœnig; Hiern, l. c. 208; Thwaites, Enum. Pl. Zeyl. 180; Bedd. Fl. Sylv. t. 65; a large tree of South India and Ceylon, with glabrous, shining leaves, anthers 16-32 on 8 filaments, each filament divided into 2-4 antheriferous branches, albumen not ruminated.

D. quæsita, Thwaites Enum Pl. Zeyl. 179; Hiern, l. c. 174; Bedd. Ic. Pl. Ind. Or. t. 128; a large tree of Ceylon, furnishes the most valuable of the timber known as *Calamander*, a beautiful wood for ornamental cabinet-work, with alternate bands of brown and black, caused probably by the irregular ramifications of the darker-coloured heartwood.

2. **D. montana**, Roxb. Cor. Pl. t. 48; Fl. Ind. ii. 538; Wight Ic. t. 1225.—Syn. *D. cordifolia*, Roxb. Cor. Pl. t. 50; Fl. Ind. 538; *D. Goindu*, Dalz. Bombay Fl. 141; *D. Waldemarii*, Klotzsch in Reise Prinz Wald. t. 55. Vern. *Hirek*, *keindu*, *temru*, *pasendu*, Pb.; *Tendu*, *dasāundu*, *lohāri*, N.W.P.; *Bistēnd*, Oudh; *Makar tendi*, Banda; *Pasend*, Bhurtpur; *Temru*, Meywar; *Ambia*, Banswara; *Hādru*, Panch Mehals; *Kanchan*, *kadal* (Forsyth), *Pattewar*, *patwan* (R. Thompson), C.P.

A moderate-sized tree, pubescent or tomentose, rarely glabrate, often armed with spinescent branchlets. Leaves always alternate, varying in shape, oblong linear-oblong elliptic- or obovate-oblong, from a rounded or cordate base, acuminate, 3-6 in. long, with 4-8 main lateral nerves on either side of midrib, and several smaller intermediate ones; petiole less than ¼ in. long. Male flowers 2-6, sometimes more, in pedunculate, axillary or extra-axillary bracteate cymes, peduncle somewhat longer than petiole. Calyx deeply 4-cleft, lobes ovate, obtuse, pubescent or glabrous and ciliate at the edges. Corolla urceolate with 4 short lobes. Stamens 16, glabrous, in two series, the 8 inner shorter, opposite to the outer stamens, and connate with them at the base; anthers longer than filaments, more or less cuspidate, somewhat exserted. Female flowers solitary, axillary, larger than male flowers, nodding, pedicels as long as, or somewhat longer than petiole, with 2 small bracts at the apex. Calyx deeply 4-cleft, lobes ovate, pubescent or glabrous. Staminodes 4, 8, or 12, in one series. Ovary glabrous, 8-celled, 1 ovule in each cell. Fruit globose, ½-1½ in. diam., supported by the enlarged leathery calyx. Seeds 2-8, albumen not ruminated.

Common, but not gregarious, in most parts of India, excepting Sindh and the northern part of the Panjab. In the sub-Himalayan tract the Ravi is its north-western limit. It is found in Harriana, in the plains to the west of Delhi, in the public forest (Ghunna) near Bhurtpur, and in the Gangrar forest between Humirpur and Chitor (Meywar). Planted in Central Sindh (J. L. S.) Leaves renewed Feb.-March; fl. March-May; the fruit ripens in the ensuing cold season.

Generally 20-30, occasionally 50 ft. high, with an erect, not very straight, somewhat angular trunk. Girth 3-4, at times 5 ft.; branches lax, wide-spreading, branchlets drooping. Bark ½ in. thick, dark grey to rusty brown, smooth, rough in old trees from exfoliating scales. Inner bark woody, not fibrous, light yellow, turning orange, astringent. Wood beautifully variegated with black and white streaks, hard and durable, a beautiful furniture-wood. Twigs and leaves lopped for fodder in Oudh. The fruit has an unpleasant smell, a bitter taste, and a viscid bitter pulp; it is not eaten.

D. lanceæfolia, Roxb. Fl. Ind. ii. 537, Hiern, l. c. 213, is a moderate-sized tree, with coriaceous, oblong or lanceolate, acuminate leaves, narrowed at the base, male flowers fascicled in short cymes, corolla tubular, and tomentose subglobose fruit 1 in. long, Eastern Bengal, noted by Madden, l. c. 378 (vern. *Ardinia*), from the Kota Doon in Kamaon, which requires confirmation.

3. **D. Chloroxylon**, Roxb. Cor. Pl. t. 49; Fl. Ind. ii. 538.—Syn. *D. capitulata*, Wight Ic. t. 1224, 1588 (bis). Vern. *Ninai*, Surat, Nasik.

A tree or large shrub, with deeply-cracked bark; tomentose, sometimes armed with spinescent branchlets. Leaves alternate, 1-2 in. long, elliptic obovate- or elliptic-oblong, pubescent above, with rust-coloured tomentum beneath. Flowers white, tetramerous, the male subsessile, in compact, sessile axillary fascicles of 6-10 flowers; bracts ovate. Calyx nearly to the base 4-cleft, lobes rounded, acute, strigose outside with stiff hairs. Corolla glabrous, except 4 lines of hairs outside. Stamens 16, glabrous, in 2 rows, the inner smaller, inserted on the base of the corolla, anthers broad-oblong or ovate-oblong, as long as filaments. Female flowers solitary, sessile or subsessile. Calyx strigose outside, corolla glabrous, ciliate with long stiff hairs at the edges of lobes. Staminodes 7-9, glabrous. Ovary glabrous, 8-celled, 1 ovule in each cell. Styles 4. Fruit globose, ⅓ in. diam., eatable. Seeds 2-3, albumen uniform.

South India, as far as Orissa on the east, and Guzerat on the west coast. Fl. June. Wood yellow, hard and durable.

4. **D. Lotus**, Linn.—**Tab. XXXVI.**—Vern. *Amlok*, *amlūk*, *malūk* (the male tree *Gwalidār*), Pb.

A middle-sized tree, nearly glabrous, young branchlets and under side of young leaves only strigose with scattered hairs. Leaves alternate, 3-6 in. long, ovate- or elliptic-oblong, acuminate; main lateral nerves 6-8 pair, petioles ½ in. long. Flowers tetramerous, rarely pentamerous. Calyx halfway down 4-lobed, lobes obtuse, ciliate. Corolla glabrous, lobes obtuse, ciliate at the edges. Male flowers nearly sessile, in small axillary or extra-axillary sessile clusters of 2-3 flowers. Stamens 16, in 2 series, filaments short; anthers lanceolate, cuspidate, hispid along the connective on both faces. Female flowers solitary, nearly sessile, staminodes 8, in 1 series, hairy. Ovary glabrous, hairy near apex only, 8-celled; styles 4. Fruit dark purple or blackish when ripe, shining, glaucous with bluish bloom, globose or ovoid, ½-¾ in. diam., supported by the enlarged, coriaceous, flat spreading calyx. Seed compressed, albumen uniform.

Wild, not uncommon in the western part of the Jhelam basin from the western end of the Kashmir valley at Bāramūla, to the Indus at 2500-6000 ft.

More abundant trans-Indus, in Swāt and other districts north of the Peshawar valley, N.E. Afghanistan, Beluchistan, wild and cultivated. Three trees (probably brought by Fakirs) at Jaggatsūkh in Kullu (6000 ft.) called *Bissahri pāla*, the largest 12 ft. girth. Outside India in Asia Minor, Persia, the Caucasus, China and Japan. Naturalised in South Europe. Hardy in England. The leaves turn yellow in autumn, and are shed about the end of the year, the new leaves coming out in spring. Fl. April-May; fr. June-Aug. Growth slow, 10 rings per in. radius. 30-40 ft. high in India, with a massive straight trunk, generally under 6 ft. girth. Foliage bright green. Bark 1 in. thick, dark brown or black, tesselated by cracks, somewhat resembling that of *Reptonia buxifolia*. The fruit is sweetish, and much prized by the Afghan tribes, who eat it fresh or dried, plain or with rice, and use it in sherbets. The *Lotus* of ancient writers is not this tree, but probably *Zizyphus Lotus*, p. 89.

5. **D. Embryopteris**, Persoon; Bedd. Fl. Sylv. t. 69.—Syn. *Embryopteris glutinifera*, Roxb. Cor. Pl. t. 70; Wight Ic. t. 843, 844. *D. glutinosa*, Kœnig; Roxb. Fl. Ind. ii. 533. Vern. *Gāb*, Beng., N.W.P.; *Kūsi*, Banda.

A middle-sized tree; almost glabrous, youngest leaves only silky with adpressed hairs. Leaves alternate, distichous, coriaceous, smooth, shining, oblong, 5-8 in. long, on thick wrinkled petioles less than ½ in. long. Flowers white or cream-coloured, scented, tetramerous. Male flowers in small axillary drooping pedunculate cymes of 3-6 flowers. Stamens 40; anthers linear, somewhat hairy, filaments shorter than anthers, 2 and 2 connate nearly to the anther, inserted at the base of the corolla-tube. Female flowers large, solitary, axillary, drooping, on short pedicels. Staminodes 2-4. Ovary hairy; styles 4-6, with broad, pectinate stigmas. Fruit globose, supported by the enlarged calyx-lobes, covered with rusty-coloured, mealy tomentum, glabrous at last, greyish yellow when ripe, 1½-2 in. diam.; seeds 5-8, embedded in a viscid glutinous pulp.

South India. Common on the western coast, particularly along backwaters (Bedd.), Ceylon, Burma, Bengal, Banda. In the sub-Himalayan tract, extends to the Jumna, ascending to 2500 ft. Also in Siam and Java. Evergreen, fl. March-May; fr. Dec. Growth moderate, 7-8 rings per in. radius. Attains 30-35 ft., with an erect trunk, not always straight, 4 ft. girth, spreading branches, forming an open oval crown. Bark ½ in. thick, black, generally with a thin, whitish or rust-coloured scaly pellicle. Wood pinkish grey or light brown, with dark patches, used for building, and in Ceylon for masts and yards. The fruit contains much tannin; an infusion of it is used to steep fishing nets and lines, to make them more durable. The viscid pulp of the ripe fruit is used as gum, in bookbinding, and in place of tar, for paying the seams of fishing-boats. The extract of the fruit is an excellent astringent (Pharm. Ind. 132). Oil extracted from the seeds by boiling, as well as the bark, and leaves are used in native medicine.

ORDER L. STYRACEÆ.

Trees or shrubs, with alternate simple exstipulate leaves. Flowers regular. Calyx-tube usually more or less adnate to the ovary, limb 5-, rarely 4-lobed. Corolla perigynous, regular, deeply divided into as many lobes as the calyx, or rarely twice as many, imbricate or valvate in the bud. Stamens usually indefinite, epipetalous, attached in one or more series to the corolla-tube. Ovary more or less inferior, 2-5-celled, with 2 or more ovules in each cell; style undivided; stigma capitate, entire or lobed. Fruit generally indehiscent. Seed usually 1, the embryo in the axis of a fleshy albumen.—Royle Ill. 260; Wight Ill. ii. 149.

1. SYMPLOCOS, Linn.

Trees or shrubs with yellow, white, rarely pink flowers. Leaves often turning yellow in drying. Calyx 5-lobed, lobes generally ciliate. Corolla-lobes imbricate in the bud, the petals sometimes almost free. Stamens more than twice the number of corolla-lobes. Fruit a berry crowned by the calyx-lobes. Cotyledons shorter than radicle.

Flowers pedicellate; pedicels as long as, or longer than calyx; leaves membranous or subcoriaceous.	
Flowers in terminal panicles; fruit ovoid, or nearly globose	1. *S. cratægoides.*
Flowers in short lateral racemes mostly below the leaves, on the previous year's wood; fruit ovoid .	2. *S. ramosissima.*
Flowers sessile or nearly sessile; in compound axillary spikes; leaves coriaceous.	
Fruit pitcher-shaped; calyx and ovary glabrous . .	3. *S. spicata.*
Fruit ovoid or cylindrical; calyx ciliate, ovary hairy .	4. *S. racemosa.*

1. **S. cratægoides**, Hamilton; Don Prod. Fl. Nepal. 145.—Syn. *S. paniculata*, Wall.; *Lodhra cratægoides*, Decaisne in Jacq. Voy. Bot. t. 110. Vern. *Lū*, *lāudar*, *loj*, *losh*, Pb.; *Lodh*, Kamaon; *Ludh*, Jaunsar Bawar.

A large shrub or moderate-sized tree, young shoots and leaves pilose. Leaves membranous, elliptic or ovate, acuminate, 2-4 in. long, sharply serrate, on short petioles, turning yellow in drying. Flowers fragrant, snow-white, in cymose corymbs forming terminal panicles, pedicels slender, as long as flowers, bracts linear caducous. Calyx turbinate, tube glabrous, lobes rounded, ciliate. Corolla 5-cleft nearly to the base. Stamens numerous, filaments filiform, connate in 5 bundles. Ovary 2-celled; stigma capitate, papillose. Fruit ovoid or nearly globose, $\frac{1}{4}$-$\frac{1}{3}$ in. long, crowned with the remains of calyx-limb, 1-seeded, embryo curved, cylindrical.

Himalaya 3000-8000 ft., from near the Indus to Assam. Scarce near its north-west limit. Kasia hills. The new foliage appears in May, and soon afterwards the tree is covered with a profusion of snow-white blossoms, which scent the air to some distance, and turn yellow in drying. Fr. July-Oct. Attains 30 ft., with a straight trunk 3-4 ft. girth. Young bark cinereous with large lenticels. Old bark grey, brownish, or dark bluish, rough. Wood white, hard, durable, has been recommended for turning. A yellow dye is extracted from leaves and bark, which is used to mix with madder.

2. **S. ramosissima**, Wall.; DC. Prodr. viii. 257.—Vern. *Lodh.*

A small glabrous tree. Leaves membranous, 4-6 in. long, lanceolate, or elliptic-lanceolate, long-acuminate, crenate, or with small sharp glandular teeth, petioles ⅓ in. long; main lateral nerves 6-8 pair, prominent below, joined by reticulate veins and distinct intramarginal nerves. Flowers on pedicels as long as calyx, in short axillary and extra-axillary racemes not exceeding 1½ in. in length, racemes generally on the previous year's wood, below the leaves; bracts ovate, ciliate, deciduous, 2 at the base of calyx, and 1 at the base of each pedicel. Calyx pubescent. Stamens indefinite; filaments flat, anthers didymous. Ovary 3-celled. Berries ovoid, ⅓ in. long, on short pedicels, 1-4 together in short racemes.

Himalaya, ascending to 7500 ft., from the Jumna to Bhutan, Kasia hills. Fl. April-June; fr. July, Aug. Bark dark-red brown, with close longitudinal wrinkles. Wood greyish or reddish white, close-grained, hard and strong. In Sikkim the yellow silkworm is raised on its leaves.

3. **S. spicata**, Roxb. Fl. Ind. ii. 541.—Vern. *Lodh* (seeds *Bholia*), Kamaon (Madden, Journ. As. Soc. xvii. part i. p. 570).

A middle-sized tree; glabrous, inflorescence only pubescent. Leaves coriaceous, elliptic-oblong, serrulate, 3-6 in. long, on short petioles. Flowers white, turning yellow when dry, sessile or subsessile, in axillary, compressed, shortly pedunculate or sessile flower-spikes, 1-3 in. long, each flower supported by 3 ovate pubescent bracts. Calyx and ovary glabrous. Drupes dry, 3-12, sessile, ovoid or nearly globose, contracted at the top below the persistent calyx, olive-coloured, 12-ribbed, about the size of a pea, enclosing a hard 1-seeded nut; peduncles 1-3 in. long.

Common along the Western Ghats and the mountains in the vicinity of the Ghats, ascending to 7000 ft. Burma, Kasia hills, Assam, Sikkim. Outside India this tree is found in the Indian Archipelago, China, Queensland, and New South Wales. Fl. Sep.-Dec. The nuts, which resemble a small fluted pitcher (Roxb.), are strung like beads and hung round the necks of children to prevent evil.

In Herb. Kew and Herb. Univ. Edinb. are specimens collected by Madden in Eastern Kamaon at 4500 ft., which may perhaps belong to this species, with elliptic-oblong, serrate, pubescent, membranous leaves 6 in. long, flowers sessile, calyx pubescent, ovary glabrous, in paniculate, axillary spikes ⅓ the length of leaf, the lateral spikes inserted near the base. They have been referred to *S. polystachya*, Wall., which is very near, if not identical with *S. spicata*.

4. **S. racemosa**, Roxb. Fl. Ind. ii. 539.—Sans. *Lodhra*, *savara lodhra*. Vern. *Lodh*, Beng.

A small tree, glabrous, only inflorescence pubescent. Leaves coriaceous, elliptic-oblong, serrulate, 3-6 in. long, on short petioles. Flowers yellow, fragrant, nearly sessile, on short axillary compound spikes 1-2 in. long, each flower supported by 3 ovate pubescent bracts. Calyx-lobes obtuse, ciliate. Filaments numerous, as long as the spreading corolla, inserted near its base; anthers didymous. Ovary hairy, 3-celled. Fruit oblong or cylindric, more or less distinctly ribbed, often slightly curved, nearly

½ in. long, purple when ripe, enclosing a hard 1-3-celled nut, with 1 or 2 seeds.

Burdwan, Midnapur, Kasia hills, Sikkim, Nepal, Western Ghats. Attains 20 ft. Bark rough, spongy, grey. Fl. Oct.-Dec.; fr. May. Bark used in dyeing.

There is a tree in the Babar of Kamaon and in the hill forests of Gonda and Baraich (R. Thompson), which has been referred to *S. Hamiltoniana*, Wall. It is closely allied to *S. racemosa*, but differs by longer flower-spikes, and the fruit distinctly ribbed and crowned by broad membranous calyx-lobes. *S. nervosa*, A. DC.; Wight Ic. t. 1235; a large tree on the Nilgiris, is near to *S. racemosa*.

ORDER LI. OLEINEÆ.

Trees or shrubs; leaves opposite, rarely alternate, entire or pinnate. No stipules. Flowers regular, generally in axillary or terminal cymose panicles. Calyx free, usually small, the limb of 4, 5, or more teeth or lobes, sometimes truncate. Corolla gamopetalous, with 4, 5, or more lobes, sometimes divided to the base, or wanting. Stamens 2, adnate to the corolla, alternating with the carpels; anthers 2-celled, opening in longitudinal slits; filaments usually short. Ovary superior, 2-celled, with 2, rarely 1, 3, or 4 ovules in each cell. Fruit succulent or dry, seeds with or without albumen, embryo straight.—Royle Ill. 266, 267 (*Jasmineæ*), Wight Ill. ii. 151, 157.

Fruit an indehiscent, winged samara; leaves imparipinnate .	1. FRAXINUS.
Fruit a capsule, dehiscing loculicidally, the valves septiferous.	
Leaves imparipinnate; capsule woody; no albumen . .	2. SCHREBERA.
Leaves simple or pinnatifid; capsule coriaceous; albumen fleshy	3. SYRINGA.
Fruit a drupe, with a bony or coriaceous putamen; albumen fleshy; corolla rotate; leaves simple, coriaceous . .	4. OLEA.
Fruit a berry; albumen fleshy or cartilaginous; corolla-tube short; leaves simple	5. LIGUSTRUM.
Fruit a 2-lobed berry, 1 lobe sometimes wanting; seeds without albumen; leaves unifoliolate or imparipinnate; corolla-tube cylindrical	6. JASMINUM.
Fruit flat, capsular, separating when ripe into 2 flat 1-seeded cells; leaves simple	7. NYCTANTHES.

The two principal sub-Orders of this Family, often regarded as distinct Orders, are *Jasmineæ*, with imbricate corolla-lobes, and exalbuminous seeds (*Jasminum Nyctanthes*); and *Oleineæ*, with corolla valvate, or wanting, and albuminous seeds (*Fraxinus*, *Syringa*, *Olea*, *Ligustrum*). *Olea fragrans*, however, and other species of that genus, have an imbricate corolla. *Schrebera* is somewhat anomalous, often associated with *Bignoniaceæ*, but in some respects closely allied to *Syringa*.

1. FRAXINUS, Tournef.

Trees or shrubs, with opposite, imparipinnate leaves. Flowers in racemes or panicles, polygamous or dioicous. Calyx 4-dentate, 4-cleft, or wanting. Petals 4 (Section *Ornus*), generally cohering at the base in pairs, or wanting (Section *Fraxinaster*). Stigma bifid. Fruit (samara) indehiscent, winged at the top, 1- or 2-celled, 1- or 2-seeded. Seed with a fleshy or somewhat horny albumen and a cylindrical embryo, radicle superior.

Lateral leaflets petiolulate; flowers and fruit in large terminal panicles; samara supported by the persistent calyx .	1. *F. floribunda.*
Lateral leaflets sessile; fruit in short lateral racemes; no trace of calyx at the base of samara	2. *F. excelsior.*
Lateral leaflets subsessile; fruit in numerous short lateral umbelliform clusters; samara supported by the persistent calyx	3. *F. Moorcroftiana.*

1. **F. floribunda**, Wall.—**Tab. XXXVII.**—Roxb. Fl. Ind., ed. Carey, i. 150; Pl. As. Rar. t. 277.—Vern. *Banārish*, Afg.; *Sūm*, *sūmb*, *sūnnū*, *shūn*, *hūm*, *hamu*, Pb.; *Angan*, *angou*, *dakkūri*, N.W.P.; *Kangu*, *tahāsi*, Nepal.

A large tree, with compressed branchlets. Leaflets opposite, 3-4 pair, petiolulate, ovate-oblong, long-acuminate, serrate, serratures often falcate, 4-6 in. long, glabrous above, pilose along nerves beneath; main lateral nerves prominent, 10-15 pair, often branching, joined by prominent reticulate veins. Flowers white, often bisexual, inodorous, on slender pedicels as long as flowers, in large compound terminal panicles, the lower branches in the axils of pinnate or linear floral leaves. Calyx 4-dentate, teeth sometimes short. Petals 4, oblong, narrowed at both ends, 2-3 times the length of calyx. Stamens longer than petals. Samara oblanceolate, 1-1½ in. long, acute, narrowed below, seed-part cylindrical or four-sided, supported by the persistent and somewhat enlarged calyx. Style not persistent.

Afghanistan, wild and cultivated, Kandahar, Beluchistan, trans-Indus territory, on the east flank of the Suliman range. Himalaya, not common, occasionally planted from the Indus to Sikkim, between 5000-8500 ft., in Sikkim ascending to 11,000 ft. Found locally in groups in shady parts of mixed forests. Leafless during part of winter. Fl. at various times, usually April-May; fruit ripens Aug.-Sept. Growth moderate, 8 rings per in., Wall. A tree 30 years old, 40 ft. high, and 4 ft. girth, Stewart. Hardy in England.

The finest specimens in the N.W. Himalaya are those planted near villages and temples on the Chenab, some of which are exceedingly handsome large trees, 120 ft. high, with a thick-based, erect, tall trunk, attaining a girth of 12, at times 15 ft. Bark cinereous, smooth, but with deep longitudinal cracks and transverse furrows. Wood similar to English ash, tough and hard, valued much for ploughs, jampan-poles, and in Kashmir reckoned the best wood for oars. Coral-shaped galls not uncommon on the branches.

Closely allied to this species is the *Manna Ash* of the Mediterranean region, *F. Ornus*, Linn. Italian: *Avorniello* (*Ornello*, Calabria; *Frascinu di manna*, *muddia*, *middia*, Sicily). The difference consists in long linear calyx-lobes, linear petals, many times longer than calyx, the samara not narrowed at the base, and often terminated by the base of the persistent style. The leaflets also are shorter and not long-acuminate, but vary in shape exceedingly, from narrowly lanceolate to almost orbicular. This variability has given rise to the erroneous supposition of two species or varieties, *F. Ornus* and *F. rotundifolia*. Manna is the sweet concrete juice, which exudes from cuts made in the bark. Small sticks are inserted in the wounds, round which the manna congeals like stalactites, and that which runs down to the roots is gathered on tiles or half-dry cactus leaves. The gathering of the produce begins when the stems have a thickness of at least 3 inches. The cuts are nearly horizontal, 1½-2 in. long, and 1 in. apart. One cut is made daily, beginning at the base of the tree, the next directly above the first, and so on, while dry weather lasts. In wet weather, or when the sirocco blows, the manna dissolves and cannot be collected. The best time for notching is July and August, and the weather most favourable to produce is that in which there are steady north and north-west winds, dry air, moderate heats and calm nights. In the second year the cuts are made in the untouched part of the stem, and when after some years the tree has been all cut round, it is exhausted, and should be felled. The trees are replaced by coppice-shoots from the stool, and by planting. This is the procedure in Sicily, as described by Dr Cleghorn in Trans. Bot. Soc. Edinb. vol. x. 1870, p. 132.

F. retusa, Champ. of China, is also near to *F. floribunda*, but the calyx is larger and truncate, and the samara is always emarginate.

2. **F. excelsior**, Linn.; Hook. Stud. Fl. 238.—Vern. *Sūm, kūm*, Pb.

A large glabrous tree. Leaflets 3-5 in. long, 1½-2 in. broad, 2-4 pair, elliptic, or elliptic-oblong, acuminate, serrate, membranous, the terminal petiolulate, the lateral sessile or subsessile, with grey or tawny floccose pubescence underneath along the midrib; main lateral nerves 6-8 pair. Samaras on slender pedicels, in lateral drooping racemes, sometimes compound at the base; linear, 1-1½ in. long, ⅓ in. broad, flat, with 5 or more longitudinal nerves from the base, branching and anastomosing above the seed-part; base narrowed, without any trace of calyx, apex acute, obtuse or emarginate, often with the remains of style.

I have examined numerous specimens from N.W. India, but only in fruit. There is no doubt, however, that it belongs to the section *Fraxinaster* without corolla. *F. syriaca*, Boiss., which is found in Afghanistan, has elliptic samaras, grey and subcoriaceous leaves; the other allied species (or varieties) of Western Asia and South Europe (*F. oxyphylla*, Bieb., *F. rostrata*, Gussone, *F. australis*, Gay, and *F. angustifolia*, Vahl), have lanceolate and deeply serrate leaflets. It thus stands nearer to *F. excelsior* than to any other species known to me, the principal difference being in the number of leaflets, which are 4-6 pair in the common ash. But forms with 1-4 pair are not uncommon, and there is a well-known variety with unifoliolate leaves (*F. heterophylla*, Vahl). However, until flowering specimens are examined, the identification of this tree with *F. excelsior*, which was first made by Dr Stewart, must be regarded as provisional.

N. W. Himalaya. Basin of the Jhelam, Chenab and Ravi rivers, between 4000 and 6000 ft. Europe, Caucasus, North Persia (Buhse). New leaves and flowers in April, May; fr. June, July. A large, handsome tree in the N.W. Himalaya, 50-60 ft. high, with a straight tall trunk, attaining 7 ft. girth, branches erect or spreading, often with drooping branchlets, forming a lax, oval, pyramidal crown, in old trees rounded. Bark ½ in. thick, or more, brownish-grey, or greyish- or yellowish-green, smooth between longitudinal cracks.

The wood of the European Ash is whitish, with brown, often mottled heartwood, the medullary rays are narrow and very numerous, the annual rings clearly marked, each ring consisting of an inner belt, which is very porous, the tissue between the medullary rays being mainly composed of numerous large pores, and an outer more compact belt with few pores. Its weight varies between wide limits; slowly-grown wood, with narrow rings and a larger proportion of porous tissue, being sometimes lighter than wood which had grown more rapidly. According to Nördlinger (Die technischen Eigenshaften der Hölzer. 520), the specific gravity is between 0.57 and 0.94. Tredgold (Principles of Carpentry) gives 0.690 to 0.811, or 43.1 to 50.7 lb. per cub. ft., but I have seen pieces of English Ash weighing as much as 55 lb. The wood is highly prized on account of its toughness and elasticity, it takes a beautiful polish, and is largely used for wheelwork, oars, handles of tools, and furniture.

The Ash in Europe requires much light, but grows with great rapidity when young, and with its powerful terminal shoots pierces readily through thickets of the Beech, with which it is often associated. In this respect it somewhat resembles the Teak, which, though it requires much light, will yet hold its own in a mixed forest, because the leaders of the young trees are able to pierce through thickets of Bamboos and other trees. Pure Ash forests are unsatisfactory, because the foliage of the older tree is light and does not cover the ground sufficiently; but, mixed with Beech, the tree grows well, and the stems attain great height and girth. In certain localities, and under certain circumstances, the Ash keeps ahead of the Beech to an advanced age, and in such places the green heads of the tree stand out from the mass of the more yellowish-green foliage of the Beech; in other places, the Beech is said to overtake the Ash when older. The study of this tree in the forests of Europe has a particular interest for Indian foresters, owing to the similarity of its growth to the Teak. The Beech forests of Buckinghamshire, the mixed forests (*Beech*, *Wych* or *Mountain-elm*, *Ash*, *Sycamore*, and *Acer platanoides*) of Lauterberg on the Harz, and the forests on the Rauhe Alp near Urach in Würtemberg, are very instructive for the study of this interesting tree.

The Ash coppices well. The finest planted coppice-woods of Kent, for the production of hop-poles and hoops, consist of Ash and Sweet Chestnut. It is for farther inquiry whether the Himalayan tree here described possesses the numerous excellent qualities of the European Ash.

3. **F. Moorcroftiana**, Wall.—Syn. *F. zanthoxyloides*, Wall.; DC. Prodr. viii. 275. Vern. *Shang*, Afg.; *Hanūz*, *nūch*, *shūlli*, *chūj*, *sīju*, *chūm*, *thūm*, *sandal*, *shangal*, *būtru*, Pb.; *Auga*, *gaha*, N.W.P.

A large shrub, or small tree, with compressed branchlets. Leaves approximate at the ends of branchlets, often very unequal in size on the same tree; leaflets opposite, 3-5 pair, 1-2 in. long, obtusely dentate, sessile or subsessile, the terminal narrowed into a marginate petiolule; common petiole narrow-winged. Flowers appearing before the leaves, in compact, rounded, short lateral panicles with hirsute bracts. Calyx rusty pilose outside, cleft to one-fourth into 4 broad, rounded teeth. Petals 4, linear-oblong, connate in pairs at the base. Anthers subsessile, large, erect. Fruit on filiform pedicels, drooping, in numerous short umbelliform fascicles below the leaves. Samara linear-spathulate, 1-1½ in. long, seed-part thick, ribbed and furrowed, supported by the persistent calyx, top acute, with the base of the persistent style. Seed 1, compressed, linear, with longitudinal ridges and furrows.

Afghanistan and Beluchistan. Trans-Indus territory on eastern flank of Suliman range. N.W. Himalaya, mainly in the inner more arid districts, Jhelam basin (3500-5000 ft.), Chenab, very abundant in places (3000-9000 ft.), Kunawar and Piti (5000-8000 ft.), Kamaon (9000 ft.) Often gregarious, on bare arid slopes. Fl. April; fruit ripens June-Aug. Growth slow, 20 rings per in. of radius.

Attains at times 25 ft., with a short erect trunk 5-6 ft. girth, and stiff divergent branches, forming a rounded crown. Generally a large shrub, 10-15 ft. high. Bark ¼-½ in. thick, cinereous or brown, scabrous with light-coloured specks, smooth while young, with shallow wrinkles, dark and much cracked when old, resembling the bark of *Reptonia buxifolia*. Wood light brown, with a few white specks, heavy, hard, close-grained, strong, polishes well. Used for tool-handles, yields excellent fuel. The leaves are valued as fodder for sheep and goats, and the tree is much lopped.

2. **SCHREBERA**, Roxb.

Deciduous trees, with imparipinnate leaves; flowers in terminal trichotomous, corymbose, compound cymes. Calyx campanulate, with 5 unequal teeth, often splitting into 2 lips. Corolla hypocrateriform; tube longer than calyx, limb spreading, 5-7-lobed, the lobes imbricate in bud. Stamens 2, inserted in the corolla-tube; anthers ovate-oblong, cells parallel, contiguous. Ovary 2-celled, 4 ovules in each cell; stigma bifid. Fruit a large pear-shaped 2-valved capsule, thick, woody, dehiscing loculicidally, the valves septiferous. Seeds 8, pendulous from the top of the cell, ending below in a long, lanceolate wing; testa smooth, with a thick, spongy inner coating; albumen 0, radicle short, superior, cotyledons oblong, fleshy, longitudinally plaited.

1. **S. swietenioides**, Roxb. Cor. Pl. t. 101; Fl. Ind. i. 109; Wight Ill. t. 162.—Vern. *Mōka, mōkha, gōki, ghaut, gautha* (*Thitsoayledu*, Burm.)

A moderate-sized tree, with grey branchlets and deciduous pubescent leaves, sometimes glabrate afterwards. Leaflets 3 or 4 pair, ovate, entire, sometimes ovate-lanceolate, obtusely acuminate, base often unequal-sided, blade 2-4 in. long, the lateral leaflets short petiolulate, the terminal on a petiolule half the length of blade; main lateral nerves 6-8 pair, with shorter intermediate ones. Flowers fragrant at night. Cymes regularly trichotomous, 3-6 in. long, and equally broad, ramifications and linear bracts pubescent. Calyx pubescent. Corolla ½ in. long, white and brown, fragrant, the inside of lobes with elevated brown glandular dots. Capsule pendulous, rough with white elevated specks, 2 in. long.

Found here and there, common in places, but not gregarious, in South and Central India, and in Burma. In Western India I found it in Banswara, and in the Bassi forests of Meywar, N.E. of Chittor. Said to grow in Sindh, on the hills west of the Indus (Graham, Bombay Cat. 112). In the sub-Himalayan tract only known from the south-east corner of Kamaon. Bare for several months, the new leaves come out April-May; fl. Feb.-April.

A middle-sized tree, attaining 40 ft., but generally smaller. Trunk erect, straight, 4-5 ft. girth, with numerous branches. Bark ash-coloured, scabrous. Heartwood yellowish grey, close-grained, hard, 50 lb. per cub. ft., seasons well, without warping and splitting, works freely and is durable. Used for the beams of weavers' looms, for making combs, and in turning. Has some of the qualities of boxwood.

A second species is described by S. Kurz in Flora, 1872, p. 398, as *S. pubescens* from Jubbulpore, with subsessile leaflets. I have not seen specimens, and the matter requires farther inquiry on the spot.

3. SYRINGA, Linn.

Shrubs or small trees, with entire or pinnatifid deciduous leaves; flowers in a terminal thyrsus, consisting of numerous compound trichotomous cymes. Calyx more or less persistent, campanulate, 4-toothed, teeth often small. Corolla hypocrateriform; tube longer than calyx, limb 4-lobed, the lobes valvate in bud. Stamens 2, inserted on the corolla-tube. Ovary 2-celled, 2 ovules in each cell; stigma bifid. Fruit a coriaceous capsule, more or less cylindrical, 2-celled, 2-valved, dehiscing loculicidally, the valves septiferous. Seeds pendulous in pairs from the top of each cell, with a narrow wing all round. Embryo straight in a fleshy albumen, cotyledons foliaceous, radicle superior.

Leaves elliptic-oblong, pale beneath, 3-5 in. long, young parts pubescent . . . . 1. *S. Emodi.*
Leaves lanceolate elliptic or pinnatifid, 1-2 in. long; wholly glabrous . . . . 2. *S. persica.*

1. **S. Emodi,** Wall.; Royle Ill. t. 65.—Vern. *Ban phūnt*, *ban dākhūr*, *banchir*, *razli*, *juari*, *rangkrūn*, *rangchūi*, *kchimu*, *lolti*, *leila*, *shafri*, *shapri*, *dūden*, *chilanghati*, Pb.

A large deciduous shrub; glabrous, inflorescence only and young leaves pubescent. Leaves elliptic-oblong, entire, base acute, apex short-acuminate, pale beneath, blade 3-5 in., petiole 1 in. long; main lateral nerves 6-8 pair, arcuate. Flowers purplish lilac, scented; thyrsus pyramidal, 3-6 in. long, with lanceolate deciduous bracts, the lower branches in the axils of leaves, flowers on short pedicels, crowded in short compact cymes. Calyx-teeth triangular, often very short. Corolla-lobes linear-oblong, generally with an inflexed point: tips of anthers exserted. Capsule cylindrical, acute at both ends, $\frac{3}{4}$ in. long, often curved.

Safedkoh, trans-Indus 9000 ft. Abundant in many parts of N.W. Himalaya, from the Indus to the Sarda, ascending to 11,000 ft., in the outer moister ranges, as well as in the inner more arid tracts (Lahoul). Hardy in England. A cultivated form raised from Himalayan seed, is described and figured in Bot. Reg. vol. 31, tab. 6, with white flowers, and a heavy unpleasant smell. Fl. May-Aug.; fr. Sept.-Oct. Attains 8-10 ft., the bark of branches is warted with large whitish lenticels. Wood white, even- and close-grained. Leaves used as fodder for goats.

2. **S. persica,** Linn. Bot. Mag. t. 486.—Vern. *Hiāsmīn*, Kashmir.

A glabrous shrub. Leaves elliptic lanceolate or pinnatifid, 1-2 in. long. Flowers white or purplish lilac, scented, thyrsus narrow pyramidal, 6-8 in. long, with linear bracts; flowers in regular, trichotomous, but often incomplete cymes, the terminal on pedicels $\frac{1}{8}$-$\frac{1}{4}$ in. long, the lateral often subsessile. Limb of corolla spreading, lobes ovate or obovate, acute, edges thickened. Capsule cylindrical, $\frac{1}{2}$ in. long.

Cultivated in Kashmir and at Lahore. Found (apparently wild, with entire leaves) by Dr Stewart near Kānigorum, the chief village of Waziristan, on the eastern flank of the Suliman range, at 8000 ft. Believed to be indigenous in Persia, whence it has been introduced to Europe; hardy in England, and grown everywhere in gardens with *Syringa vulgaris*, Linn., which is marked by broad-ovate or cordate leaves. Leafless in winter ; fl. April-May.

4. OLEA, Linn.

Trees or shrubs, with opposite, coriaceous, persistent leaves. Flowers often unisexual. Calyx shortly campanulate, 4-dentate or truncate. Corolla with a short tube and 4 spreading lobes, valvate or imbricate in bud (in a species not Indian wanting). Stamens 2, exserted. Ovary 2-celled, 2 ovules in each cell ; style short, stigma bifid, or capitate. Fruit a drupe, the endocarp usually hard, the exocarp fleshy. Seed solitary, rarely 2, albumen fleshy, its cells filled with oil. Embryo straight, nearly as long as the seed, cotyledons foliaceous, radicle superior.

Lateral nerves indistinct, leaves clothed beneath with a film of reddish scales	1. *O. cuspidata.*
Lateral nerves distinct, leaves without scales beneath.	
Flowers in compound trichotomous cymes ; corolla-lobes valvate	2. *O. glandulifera.*
Flowers in umbelliform fascicles ; corolla-lobes imbricate .	3. *O. fragrans.*

1. **O. cuspidata,** Wall.—**Tab. XXXVIII.**—Syn. *O. ferruginea*, Royle Ill. t. 65. Vern. *Khwan, shwan*, Trans-Indus ; *Zaitūn*, Afghanistan (Griffith). *Ko, kohū, kāo, kāu*, Pb. ; *Kāu*, N.W.P. ; *Kahū, khāu*, Sindh.

A middle-sized unarmed tree. Branchlets, petioles, and inflorescence clothed with a white or grey film of minute scales. Leaves oblong-lanceolate, cuspidate, entire, 2-4 in. long, shining above, thickly clothed beneath with a dense ferruginous or red film of scales, the scales minute, orbicular, fixed in the centre, circumference minutely and irregularly dentate ; midrib prominent ; lateral nerves invisible beneath, indistinctly visible on the upper surface, anastomosing by intramarginal veins. Flowers whitish, bisexual, in axillary, more or less regularly trichotomous cymes, generally shorter than leaf, equalling about half its length. Bracts linear, caducous ; the lateral flowers sessile or subsessile, the terminal pedicellate. Calyx short-campanulate, with 4 short teeth, nearly truncate. Corolla rotate, lobes ovate, acute with a distinct midrib, valvate in bud. Anthers oval, the cells contiguous on the outside, dehiscing laterally, separated on the inside by the broad elliptic connective ; filaments short, affixed at the back, a little above the base, between the contiguous cells. Style short, stigma thickened, bifid. Drupe ovoid, about $\frac{1}{4}$-$\frac{1}{3}$ in. long, black when ripe, supported by the remains of calyx ; pulp scanty, oily, putamen thick, hard, bony.

Abundant in the trans-Indus territory, one of the characteristic trees on the eastern flank of the Suliman range. In Afghanistan, Beluchistan, the hills of West Sindh, the Panjab Salt range, and in many parts of the outer ranges of the N.W. Himalaya, ascending to 6000 ft., and extending east to the Jumna river. Not uncommon on the Tonse river, near Bastil (D.B.)

I cannot follow Dr Stewart and others in identifying the Indian tree with *Olea europæa*, L. The distinguishing characters of the Indian tree are a more lax inflorescence, the upper side of the leaves deep glossy green, not grey or dull green, as in the Mediterranean tree, the under side red or ferruginous instead of white, smaller fruit, the absence of spines, and a more distinctly marked heartwood. These, it is true, are not characters to which systematic botanists commonly attach much value, but the appearance of the trees is different, and there is this important fact, that though the tree is common in Sindh and the hills of the Panjab, there is no trace of its ever having been cultivated, and the fruit turned to account on a large scale in those countries. Should eventually intermediate forms be discovered, and should botanists agree to regard the Indian and West Asiatic tree as one species, then the remarkable fact will have to be explained that the art of improving the tree by cultivation, and grafting it, was not practised in the Panjab at an early age. In Palestine the Olive tree has been cultivated from time immemorial for the sake of its oil, and in Greece also its cultivation is very old, for Solon (early in the sixth century, B.C.) enacted laws regarding the growth of the Fig and the Olive. The tree is indigenous in Syria, and probably in Greece also. Greek colonists carried the tree westward, to Italy, Istria, Spain, and the South of France, and thus the Olive has gradually become completely naturalised in the western Mediterranean region, for it spreads readily, and the self-sown or bird-sown seedlings revert more or less to the wild form. The eastward spread of the Olive has been much less marked. At the time of Herodotus, in the fifth century, B.C., the Olive was not known in Persia, and in India the attempts made to grow the Mediterranean Olive are of recent date, and have not hitherto been successful. The real Olive is called *Zaitūn* in Persian and Arabic; it has no Sanskrit name, and Olive oil is not mentioned by old Sanskrit writers. Few subjects are more interesting than the spread of the cultivation of this useful tree, and the interest is heightened by the close affinity of the West Asiatic and Indian species.

The Indian tree grows gregariously, the leaves are shed in January and February, and are renewed immediately afterwards. It flowers from April to May, sometimes in September; the fruit ripens Aug.-Nov. The growth is slow. The tree is often kept down by lopping, but when it gets fair play and some protection it attains a considerable size, 30-40, rarely 50 ft., with a short massive trunk, often gnarled and bent, girth 6, at times 10-12 ft. Branches stiff, crooked, widespreading, forming a broad depressed rounded crown. The foliage is deep glossy green. The branches are always unarmed, whereas they are often spinescent on the wild Olive of the Mediterranean region. Bark thin, smoothish, undulated while young, when old exfoliating in long irregular narrow strips. Heartwood with a well-defined outline, dark brown, often nearly black and beautifully mottled. Sapwood yellowish. The wood of the Mediterranean tree is yellowish brown, irregularly mottled and veined with dark blackish-brown veins. In weight and structure there seems to be no marked difference. Wood from Sindh weighs 65 lb., and this is about the weight of the Mediterranean wood. The medullary rays are fine and very close together; the wood is marked by numerous whitish dots generally arranged in wavy concentric lines. Annual rings not very distinct, often marked by a dark line without dots. The wood takes a beautiful polish, is very hard, is highly prized for turning, for crooked timbers of the Indus boats, and agricultural implements; combs are carved of it. It yields excellent fuel, and makes good charcoal. The fruit is a favourite food of crows, and ripe fruit is not often seen on the trees. The pericarp is oily, like that of the real Olive tree. In Afghanistan oil is extracted from the indigenous tree in a small way, and used medicinally (Irvine, Bellew), and about 1851 an experiment was made in Kohat to extract oil on a larger scale. The oil was excellent, but the quantity obtained was insufficient to repay an extension of the process. So much, however, is clear, that oil can be made from the fruit of the

Indian tree; and it seems probable, that by grafting or other means the yield may eventually be improved.

2. **O. glandulifera**, Wall.; Wight Ic. t. 1238; Bedd. Fl. Sylv. t. 238. —Syn. *O. paniculata*, Roxb. Fl. Ind. i. 105, not *paniculata*, R. Brown (an Australian species); *O. Roxburghiana*, Roem. et Schultes. Vern. *Gūlili*, *rabān*, *sīra*, *phalsh*, Pb.; *Gair*, *galdu*, *garūr*, Kamaon.

Wholly glabrous. Leaves ovate or elliptic, long-acuminate, entire, blade 4-5 in., petiole 1-1½ in. long; main lateral nerves 6-8 pair, on the under side with small oval, open hollow glands in their axils. Flowers white, in terminal and lateral pyramidal compound trichotomous cymes; bracts deciduous. Calyx 4-toothed. Corolla rotate, lobes valvate. Anthers like those of *O. cuspidata* and *europæa*. Fruit ovoid, shortly acuminate, putamen with a thin, crustaceous or woody shell.

Outer Himalayan ranges between 2500 and 6000 ft., from the Indus to Nepal. Mountains of South India. Scattered in mixed forests, in moist shady ravines, often associated with *Acer oblongum*. Fl. March-May, sometimes in August. The fruit ripens Nov.-Feb., and often remains long on the tree. A small or middle-sized tree, trunk short, straight, girth 5-6 ft., branches widespreading, forming a handsome, broad, rounded depressed, umbrageous crown. A very large tree on the Nilgiris. Young branches tetragonal, light coloured, and warty with lenticels, bark of trunk ¼ in. thick, grey with elevated white specks, very uneven, exfoliating with brittle scales. Wood pale brown, with some white dots on transverse section, medullary rays and pores broader and larger than in *O. europæa* and *O. cuspidata*. Moderately hard, close, compact, not very dense, capable of a high polish, not touched by insects, durable. Employed in construction, carpentry and turnery, and for agricultural implements. Growth moderate. A section of a tree 43 years old (Hort. Calc.) showed 43 rings, on a radius of 10 in. The bark is medicinal, the leaves are used as fodder.

3. **O. fragrans**, Thunb.; Roxb. Fl. Ind. i. 105; Bot. Mag. t. 1552.—Syn. *O. acuminata*, Wall.; *Osmanthus fragrans*, Loureiro; DC. Prodr. viii. 291. Vern. *Shūlling*, *silang*, Kamaon.

A small tree, wholly glabrous. Leaves lanceolate- or elliptic-oblong, blade 4-5 in. long, acuminate, narrowed into petiole ½-¾ in. long, entire (in cultivated trees often serrate); lateral nerves numerous, anastomosing by prominent reticulate and intramarginal veins. Flowers dioicous, white, exceedingly fragrant, on long slender pedicels, in axillary, rarely terminal umbelliform fascicles. Male flowers: corolla-lobes oblong, imbricate, many times longer than the small 4-toothed calyx; anthers like those of *O. cuspidata* and *europæa*. Rudiment of ovary of 2 white falcate lobes. Fruit a blue, glaucous ovoid drupe, ¾ in. long; putamen with a hard woody shell. Embryo cylindrical, radicle longer than cotyledons.

I follow Bentham, Fl. Hongkongensis, 215, and Miquel, Ann. Mus. Lugd. Bot. ii. 264, in replacing this species under *Olea*. There are other species with imbricate corolla-lobes; the fertile specimens from Kamaon are in fruit only.

In Sirmore and Kamaon planted by temples and villages, and at passes, beween 2800 and 6800 ft. At one place, near Kapkot, it covers a considerable area as a shrub; but it is uncertain whether it is originally indigenous in the North-West Himalaya. Apparently wild in Eastern Bengal and on the Island of Nipon (Japan), Miquel l. c. Cultivated in Japan, China, and most tropical countries. In May, June, sometimes in Sept., the tree is covered with an abundance of white or light-yellow flowers with an exquisite fragrance, which the least breath of wind carries a distance of several hundred yards. Growth slow, 13 rings per in. radius. In Japan often a large tree (fl. in Oct.), in Kamaon a small tree or shrub; bark ⅓ in. thick, dark or light-grey, irregularly longitudinally rugose, and scabrous with elevated tubercles. Wood whitish, mottled with brown. In Kamaon the flowers are placed among clothes to keep off insects, in China they are used to flavour tea.

5. LIGUSTRUM, Linn.

Shrubs or small trees, with opposite, entire leaves. Flowers bisexual, in terminal trichotomous panicles. Calyx small, 4-toothed. Corolla with a short tube and 4 lobes, valvate or slightly imbricate in the bud. Ovary 2-celled, 2 ovules in each cell; style short. Fruit a berry. Seeds 4 or fewer; albumen copious, fleshy or almost cartilaginous; cotyledons foliaceous, radicle superior.

1. **L. robustum**, H.f. & Th.—Syn. *Phillyrea robusta*, Roxb. Fl. Ind. i. 101. *Olea robusta*, Wall.; Wight Ic. t. 1242. *Visiania robusta*, DC. Prodr. viii. 289. Vern. *Keri, banpatāra*, N.W.P.

A moderate-sized tree, nearly glabrous. Branchlets dotted with small elevated white specks. Leaves ovate or ovate-lanceolate, coriaceous, glabrous on both sides, shining above. Flowers white, subsessile; bracts linear, deciduous. Ramifications of panicle pubescent, with long soft hairs. Calyx cup-shaped, truncate or 4-dentate. Corolla-tube short; lobes oblong, valvate in bud. Anthers on short filaments. Berry cylindrical, often curved, ⅓-½ in. long.

Mountains on the west side of the peninsula. Bengal, Nepal, and Kamaon, 2500-8000 ft. Fl. April-June; fr. Nov.-Feb. In mixed forests, scattered, a handsome, middle-sized tree, 40 ft. high, trunk erect, 4-5 ft. girth, branches ascending, forming an oval crown. Bark cinereous, scabrous with numerous warts. Wood light-brown, often with white dots, fairly close and durable, said to be somewhat brittle. In South India the bark is put into the toddy of *Caryota urens*, to cause immediate fermentation. Closely allied are the following trees:—

1. *L. compactum*, H.f. & Th. (*Olea compacta*, Wall.) Branchlets without elevated specks; panicles compact, perfectly glabrous; berries ovoid or subglobose, ¼ in. long. North-West Himalaya, Sarda to the Bias, at 3500-6000 ft. (Karama peak, Deoban range, D.B., June 1863). Fl. May-July.

2. *L. nepalense*, Wall. in Roxb. Fl. Ind., ed. Carey, i. 151; Pl. As. rar. t. 270. —Syn. *L. spicatum*, Don Prodr. Fl. Nep. 107. *The Nepal Privet.* Vern. *Gumgacha*, Nepal. Branchlets dotted with callous spots. Flowers white, subsessile, in compact villous panicles; bracts minute, deciduous. Calyx truncate or indistinctly 4-toothed. Berries ovoid, dark blue, with a beautiful bloom on them. Nepal. Fl. April-June.

3. *L. bracteolatum*, Don l. c. 107, differs by linear-lanceolate bracts and more spreading panicles. Berries (always?) subglobose. Garhwal, Kamaon, 2500-7000 ft. Nepal.

These species of *Ligustrum* require farther study.

6. **JASMINUM,** Linn.

Shrubs or climbers, with opposite, rarely alternate, imparipinnate, or unifoliolate leaves. Flowers white or yellow, in axillary or terminal trichotomous cymes. Calyx-lobes 5-10. Corolla-tube cylindrical or clavate, the limb spreading, 5-12-lobed, the lobes imbricate, often contorted in the bud. Stamens included in the tube. Ovary 2-celled, 1, 2, rarely 3 ovules in each cell; style minutely 2-lobed at the tip. Berry 2-lobed almost to the base, or entire by the failure of 1 carpel. Seed usually 1 in each lobe, erect, without albumen; cotyledons thick and fleshy, radicle inferior.

Leaves opposite, simple, unifoliolate, the petiole articulate below the middle.	
Flowers pedicellate, solitary or in lax trichotomous cymes.	
Pubescent; calyx-segments 5-9, longer than calyx-tube	1. *J. Sambac.*
Pubescent; calyx-segments 5-6, as long as tube or twice its length.	
Erect, not climbing	2. *J. arborescens.*
Climbing	3. *J. latifolium.*
Glabrous; calyx-segments 5-6, as long as tube	4. *J. glandulosum.*
Flowers subsessile, in compact corymbose cymes	5. *J. hirsutum.*
Leaves opposite, imparipinnate, leaflets 1 or 2 pair; or leaves unifoliolate	6. *J. dispermum.*
Leaves opposite, all imparipinnate, leaflets 1-3 pair, the terminal largest; calyx-segments nearly as long as corolla-tube	7. *J. officinale.*
Leaves opposite, all imparipinnate, leaflets 3-5 pair, the lowest larger, the upper 1 or 2 pair confluent with the terminal leaflet	8. *J. grandiflorum.*
Leaves alternate, imparipinnate, leaflets 1-5 pair	9. *J. revolutum.*

There are other species within the range of this Flora; a selection has been made of the more common kinds.

1. **J. Sambac,** Aiton; Roxb. Fl. Ind. i. 88; Wight Ic. t. 704.—Sans. *Mallika, āsphota, saptala;* Pers. *Zambac.* Vern. *Chamba, mūgra, bēl.*

A shrub, generally climbing, pubescent. Leaves glabrate, opposite, 2-3 in. long, on short petioles, elliptic or rotundate, entire, shortly and obtusely acuminate; main lateral nerves 4-6 pair. Flowers white, fragrant, solitary, or in 3, 5- or 7-flowered terminal cymes. Calyx-segments 5-9, linear, hairy, longer than calyx-tube, and half the length of corolla-tube or more. Berry-lobes subglobose, 1 or 2.

Cultivated, on account of its delightfully fragrant flowers, in numerous varieties, erect and climbing, with larger and smaller, double and single flowers, throughout India, and in most tropical countries. Believed to be indigenous in the peninsula. Fl. H.S.

2. **J. arborescens,** Roxb. Fl. Ind. i. 95; Wight Ic. t. 699; a tall shrub: and 3. **J. latifolium,** Roxb. Fl. Ind. i. 95; Wight Ic. t. 703; a climber,—are in all other respects so much alike, that with abundant specimens before me, from Oudh, the Central Provinces, the North-West Himalaya, and other parts of India, I find it impossible to draw up distinct

descriptions. Farther researches on the spot must decide whether these species should not, as suggested in Wight Ic. t. 703, be regarded as one.

More or less pubescent. Leaves opposite, ovate from a broadly rounded, rarely cordate base, acuminate, entire, soft-tomentose on both sides when young, more or less glabrous afterwards, blade 3-5 in. long, 2-3 in. broad, petiole ½-¾ in. long; main lateral nerves 6-8 pair, 3 or 4 pair approximate, from the lowest third of the midrib. Flowers white, fragrant, in lax terminal trichotomous, more or less compound cymes, with linear bracts; pedicels as long as calyx, or twice, rarely 3 times its length. Calyx-lobes 5 or 6, linear, as long as calyx-tube, or twice its length, always shorter than corolla-tube. Corolla-lobes 10 or 12, linear, acute or cuspidate. Berries 1 or 2, ovoid or oblong, often oblique, ⅓-½ in. long, longer than calyx-segments.

Common in most parts of India, except in the arid region and the northern Panjab. In the outer Himalaya extends to the Jumna, and ascends to 4000 ft. Often cultivated in gardens, also in the Panjab. Fl. H.S. Branches with smooth, greyish bark.

4. J. **glandulosum**, Wall.; Royle Ill. p. 268.

A climbing shrub, wholly glabrous. Leaves shining, lanceolate or ovate-lanceolate, blade 3-4 in., petiole ¼ in. long. Flowers on long filiform pedicels many times longer than calyx, generally bibracteolate about the middle, solitary, or in few-flowered lax terminal cymes. Calyx-lobes 5 or 6, linear, as long as tube. Corolla-tube slender, 1-1¼ in. long; lobes 6-8, linear, a little shorter than tube.

Kamaon, ascending to 4500 ft., Sikkim, Kasia. Fl. June, July (yellow, Royle; white, Don Syst. iv. 61).

5. J. **hirsutum**, Willd.; Wight Ic. t. 702.—Syn. *J. pubescens*, Roxb. Fl. Ind. i. 91. Sans. *Kunda.* Vern. *Kunda, kundo.*

A large tomentose shrub. Leaves ovate from a rounded or cordate base, shortly acuminate, entire, blade 1-2½ in. long, and about ¾-1½ in. broad, petioles ¼ in. long. Flowers white, fragrant, sessile or on pedicels shorter than calyx-tube, crowded in compact, terminal, short-pedunculate corymbose cymes. Calyx-lobes 8-10, linear, hairy, many times longer than tube, nearly as long as corolla-tube. Corolla-lobes 6-9, lanceolate-oblong, cuspidate, shorter than tube.

Common in the peninsula, Burma, Bengal, Oudh, and the Central Provinces, and extends in the sub-Himalayan tract to the Jumna river. Cultivated in gardens. Fl. rains and C.S. Branches grey-tomentose.

6. J. **dispermum**, Wall. Roxb. Fl. Ind., ed. Carey, i. 99; Pl. As. rar. t. 274.—Vern. *Surmali*, Kamaon.

A scandent shrub, wholly glabrous; branches slender, 4-sided, divaricate. Leaves opposite, unifoliolate, or imparipinnate, leaflets lanceolate, or ovate-lanceolate, with 3 or 5 basal nerves, the terminal 2-4 in. long, on a petiolule ½-¾ in., the lateral 1 or 2 pair, 1-1½ in. long, nearly sessile. Flowers yellowish white, fragrant, in axillary pedunculate, few-flowered cymes. Calyx with 5 short teeth. Corolla-tube clavate, ¾ in. long, segments 5, ovate, shorter than tube. Berries twin, 2-seeded, dark purple.

Kamaon, ascending to 5000 ft., Nepal, Bhutan, Kasia. Fl. H.S.

7. J. **officinale**, Linn. — Vern. *Chamba*, *chirichog*, *kiri*, Kashmir; *Bansu*, *kwer*, *dūmni*, Chenab; *Dassi*, *samsem*, Ravi.

A large twining shrub, extremities slightly pubescent. Leaves opposite, imparipinnate, 2-3 in. long, leaflets lanceolate, the terminal largest, petiolulate, lateral 1-3 pair, subsessile; common petiole marginate. Flowers white, fragrant, on pedicels longer than calyx, in terminal few-flowered corymbose cymes. Calyx-segments 5, subulate, 3 or 4 times longer than tube, nearly as long as corolla-tube. Corolla-lobes 5, acute. Berries didymous, globose.

Afghanistan, Waziristan. On top of Mount Tillah, Salt range at 3000 ft. Himalaya from Indus to the Sarda, between 3000 and 9000 ft. Fl. May, June. Cultivated in Europe. Hardy in England.

8. J. **grandiflorum**, Linn.; Roxb. Fl. Ind. i. 100; Wight Ic. t. 1257. —Vern. *Chambel*, *jati*. (*Jahi*, *chambeli*, Kamaon.)

A large scandent glabrous shrub. Leaves 3-4 in. long, imparipinnate, leaflets 3-5 pair, the lowest generally larger than those of the uppermost pair; lateral leaflets sessile, the upper 1 or 2 pair confluent with the petiole and with the terminal leaflet; common petiole marginate. Flowers white, tinged with purple outside, peculiarly sweet-scented, on slender pedicels, in terminal, lax divaricate cymes. Calyx-segments subulate, 3 or 4 times longer than tube, ½ the length of corolla-tube. Corolla-lobes 5, elliptic, obtuse or acute. Berries didymous, ovoid.

Cultivated with single and double flowers in gardens throughout India; the flowers are made into garlands. Fl. March-Aug. Wild in Nepal and Kamaon, ascending to 5000 ft.

9. J. **revolutum**, Sims.; Wight Ic. t. 1258.—Vern. *Chamba*, *jūāri*, Pb.

An erect shrub, wholly glabrous. Branches angled. Leaves alternate, imparipinnate, leaflets 1-5 pair, ovate, or ovate-lanceolate, the terminal largest. Flowers yellow, fragrant, in short, terminal, corymbose panicles. Calyx with 5 short subulate teeth. Corolla-tube ½-¾ in. long, lobes 5, broad-ovate, obtuse. Fruit didymous, berries globose.

Afghanistan. Waziristan and hills round the Peshawar valley. Salt range (on Sakēsar 3000-5000 ft.), Himalaya, Indus to Nepal, between 2000 and 9000 ft.; also in some of the drier tracts (Kunawar). Bhutan (Griff.) On the Nilgiris and the hills of Ceylon. Fl. April-June; fr. Sept.

7. NYCTANTHES, Linn.

Deciduous, with quadrangular branches and scabrous ovate opposite leaves. Calyx campanulate, truncate, with 5 - 6 inconspicuous teeth. Corolla-tube cylindrical, limb spreading, lobes 5-8, emarginate or bifid, contorted in bud. Anthers 2, sessile near the mouth of the corolla. Stigma capitate. Capsule chartaceous, compressed, 2-celled, splitting into 2 flat 1-seeded cells. Seeds erect, without albumen, radicle inferior.

1. **N. Arbor-tristis**, Linn.; Roxb. Fl. Ind. i. 86; Bedd. Fl. Sylv. t. 240.—Sans. *Sephāli*. Vern. *Har*, *sihāru*, *saihiāri*, *harsinghar*, *haringār*, *saherwa*. Local names: *Pakūra*, *ladūri*, *kūri*, Pb., N.W.P.; *Shāli*, Bassi in Meywar; *Khersāri*, *kīrsāru*, Gonds, C.P.

A large shrub or small tree, rough all over with an uneven epidermis and stiff, whitish hairs. Leaves petiolate, entire or with a few large distant teeth. Flowers sessile, in bracteate fascicles of 3; bracts obovate, the fascicles pedunculate and arranged in short terminal trichotomous cymes. Corolla-tube orange, limb white.

Cultivated throughout India on account of its fragrant flowers, which open in the evening and drop at sunrise. Indigenous in the sub-Himalayan forests from the Chenab to the Sarda river, and in Assam. Common in the Baraitch and Gonda forests of Oudh, and in Central India from the Jumna to the Godavery. The old leaves shed Feb., the fresh foliage appears April, May. Flowers more or less throughout the year, generally during the rains. Seed ripe autumn, C.S. Often gregarious in dry places, 15-20 ft. high, with a short erect trunk, 3 ft. girth. Bark ¼ in. thick, light or dark grey, greenish white or pale brown, slightly wrinkled. Coppices vigorously. R. Thompson describes a large coppice-wood of it, near Ramnuggur in Kamaon, so dense as to be almost impenetrable, from which the neighbouring villages drew their supply of fuel. Easily raised from seed. Wood brown, close-grained, but splits when drying. Only used as fuel, merits attention in that respect. The leaves are used in polishing wood. The flowers are made into garlands, and a fine but transient buff or orange-colour for cloth is made from them.

ORDER LII. SALVADORACEÆ.

Glabrous shrubs or trees. Leaves opposite, petioled, entire, with minute stipules. Flowers small, regular, tetramerous, in paniculate spikes or racemes. Calyx small, 4-lobed. Corolla hypogynous, membranous, more or less deeply 4-cleft, lobes imbricate. Stamens 4, filaments short, inserted at the base of the corolla, and alternating with its lobes; anthers 2-celled, introrse. Disc hypogynous, 4-lobed. Ovary free, 2-celled; stigma subsessile, 2-lobed, ovules geminate, ascending. Seeds 1-4, albumen none; embryo with fleshy, plano-convex cotyledons.—Royle Ill. 319 (under *Chenopodiaceæ*); Wight Ill. ii. 227.

1. SALVADORA.

Leaves subcoriaceous, main lateral nerves anastomosing by intramarginal veins. Flowers bisexual, in the axils of deciduous bracts. Fruit a 1-seeded berry, supported by the persistent calyx.

Flowers pedicellate, in lax, axillary and terminal, often nodding panicles; calyx small, open, lobes less than half the length of the reflexed petals . . . . 1. *S. persica.*
Flowers sessile, in compact erect axillary panicles, shorter than leaves; calyx cup-shaped, lobes nearly as long as the erect petals . . . . 2. *S. oleoides.*

1. **S. persica,** Linn.; Roxb. Cor. Pl. t. 26; Fl. Ind. i. 389; Wight Ic. 1621.—Syn. *S. Indica,* Wight Ill. t. 181. *S. Stocksii,* Wight Ic. 1621 B. Arab. *Arāk, irak.* Vern. *Kauri vān, kauri jal, jhār, jit, jhit,* Pb.; *Kabbar, pilu,* Sindh; *Jāl, kharjāl,* N.W.P.; *Jhāl,* Rajputana.

A large evergreen shrub or small tree, with white branches, drooping branchlets, and glaucous foliage, but much clearer and brighter green than the foliage of *S. oleoides.* Leaves varying in shape from ovate to narrow-lanceolate, blade 1-2 in. long. Flowers greenish-white, pedicellate, pedicels slender, generally $\frac{1}{6}$ in. long, but often much shorter. Panicles axillary and terminal, lax, often nodding, longer than leaves; branches racemose, divaricate. Calyx open, cleft half-way into short, broad, rounded, ciliate lobes. Corolla cleft nearly to the base into 4 oblong lobes, twice the length of calyx, and generally reflexed. Fruit globose or subglobose, 2-2½ lines long, fleshy, greenish-yellow, red when ripe, supported by the persistent yellowish cup of the calyx.

Planted, particularly near Mussalman tombs, in many parts of India. Wild in the southern part of the Multan and Dera Ghazi Khan districts, in Bhawalpur and Sindh. Plentiful in lower Sindh and on the Beluchistan hills. Doubtfully wild on rocky ground near the Kutab Minār (Delhi). "On the Ganges banks all over down to near Patna" (Madden in Hb. Kew). Wild on low ground, particularly on saline soils in Rajputana (Bhurtpur, Kishengarh, associated with *Capparis aphylla, Prosopis spicigera,* and often with *Salv. oleoides*), near the coast in Guzerat, the Konkan (the Habshi's country), in the Circars and the northern part of Ceylon. In Syria, Arabia, Egypt, Abyssinia, and in Western Africa. The old leaves are shed in April, the new foliage coming out simultaneously. Fl. Nov.-May; in the Panjab the fruit ripens in June, in Sindh in Jan., Feb. Gregarious, usually in compact clumps and masses, generally a large shrub or a small scrubby tree, but under favourable circumstances attains 30-40 ft., with a short trunk, often crooked and fluted, 8-10 ft. long and 4-5 ft. girth. Girths of 6-8 ft. are not rare in Sindh, and Edgeworth notes one tree at Pākpattan, north of Multan, 14 ft. 9 in. girth. Branches numerous, spreading, extremities drooping, like those of the weeping-willow. Bark of branches shining, almost white, light ash-grey, or darker. Bark of trunk thin, grey or brownish, irregularly rugose. Wood whitish yellow, soft, the cub. ft. (of Sindh wood) weighs 40½ lb. (Dalzell), 46 lb. (Fenner). Medullary rays numerous, fine, pores large, in concentric belts of white tissue, alternating with darker-coloured belts of nearly the same width. Easy to work, and takes a beautiful polish. White ants do not attack it, nevertheless it is but little used. It is a poor fuel, and is considered useless for building. Grows readily from seed and coppices well, but its growth is slow.

The root-bark is very acrid, and when bruised and applied to the skin acts like a blister (Pharm. Ind. 170); the twigs are used as tooth-cleaners (*miswāk*).

Shoots and leaves are a favourite fodder of camels; they are pungent, eaten as salad, and are celebrated as antidotes against poison. The fruit (*pīlu*, Pb.; *pīru*, Sindh) is pungent, bitter, and aromatic; it is used medicinally. *Salvadora persica* has been identified with the Mustard-tree of Scripture.

2. **S. oleoides**, Dne.—**Tab. XXXIX.**—Jacq. Voy. Bot. t. 144.—Syn. *S. indica*, Royle Ill. p. 319. *S. persica*, T. Anderson in Linn. Soc. Journal, v. Suppl. i. 29. Persian, *Irak-hindi* (Royle). Vern. *Jāl*, *vān*, *vāni*, *mithi vān*, Pb.; *Kabbar*, *khabbar*, *jhār*, *diār*, *mithi diār*, Sindh; *Jhal*, N.W.P.

A shrub or small tree, with stiff branches, ash-coloured or reddish grey branchlets, and dull cinereous persistent foliage. Leaves glaucous, linear-lanceolate or ovate-lanceolate, blade 1½-2½ in. long, membranous when young, coriaceous and somewhat fleshy when full-grown; main lateral nerves often indistinct. Flowers greenish-white, sessile, in erect compact axillary paniculate spikes, often clustered and shorter than leaves. Calyx cup-shaped, divided half-way or nearly half-way into 4 rounded, obtuse lobes. Corolla as long as or a little longer than calyx. Fruit globose, 2½ lines diam., yellow when ripe, dark brown or red when dry, supported by the persistent calyx and marcescent corolla.

Abundant in the driest and most desert parts of the Panjab, trans and cis-Indus, often forming great part of the vegetation for miles, ascending to 3000 ft. trans-Indus, to 2400 in the Salt range. Less common north of the Salt range. In North and Central Sindh (often associated with *S. persica*), not common generally, but in one place (near Khairpūr) more common than *S. persica*. In Harriana, Bikanir, near Delhi, Agra, Bhurtpur, farther east probably planted; also at Aden. The leaves are renewed about April, the young foliage is often dark greenish-grey, but dull grey when full-grown. Fl. generally March, April; fr. about June.

In arid and saline soil a stunted scrub, but attains 20-25 ft. under favourable conditions. Trunk short, often twisted or bent, girth 5-6 ft., 2 trees 11 ft. 4 in. and 12 ft. girth near Multan, noted by Edgeworth. Large trees generally hollow. Branches numerous, stiff, divergent, twisted, often swollen at forks. Branches stiffer and crown narrower than *S. persica*. Branchlets ash-coloured or reddish grey. Bark ½ in. thick, whitish grey, or dark grey, cleft into small plates by irregular shallow cracks, mostly longitudinal, and fewer cross-cracks. Inner substance hard compact. Wood whitish, compact, soft, weight 49 lb. per cub. ft. (Sindh). Structure similar to that of *S. persica*. Not touched by white ants in Sindh. In the South Panjab, where timber is scarce, it is often employed for building, and for agricultural implements; Persian wheels are made of it, and (in Sindh) knee-timbers of boats. A poor fuel, requires 9-12 months to dry, gives no heat, but mixed with scraps of pine-wood is useful for brick-burning. Leaves a great deal of ash, and blocks the fire-places speedily. Shoots and leaves are much browsed by camels. The fruit (*Pīl*, *pīlu*, *pinju*, Pb.; *Pīru*, Sindh) is sweet, and is eaten largely. When dried it forms an article of trade, and tastes somewhat like currants.

Ovoid cinereous galls are often formed on petioles and flower-stalks, and small clustered, deformed leaves grow frequently in large numbers among the flowers. The tree grows readily from seed, and coppices fairly well. Its growth is believed to be more rapid than that of *S. persica*, but the annual rings are very indistinct, and obscured by the numerous concentric belts of alternating white and darker tissue (often 15-16 on 1 in. of radius).

ORDER LIII. **LOGANIACEÆ.**

Trees, shrubs, often climbing, or herbs. Leaves opposite, generally connected by interpetiolar stipules or by a raised line. Flowers regular, 4-5-merous. Corolla hypogynous, regular or irregular. Stamens epipetalous, usually alternating with the corolla-segments. Ovary free, 2-celled; style simple, stigma often 2-lobed. Seeds albuminous.—Wight Ill. ii. 170; Bentham in Journ. Linn. Soc. i. 52.

Fruit indehiscent, with a shell-like rind; flowers pentamerous, corolla valvate in bud . . . . 1. STRYCHNOS.
Fruit a capsule, dehiscent septicidally; flowers tetramerous, corolla imbricate in bud . . . . 2. BUDDLEIA.

1. **STRYCHNOS**, Linn.

Trees or climbing shrubs, with entire 3-5-nerved leaves. Flowers pentamerous, bisexual. Corolla tubular or funnel-shaped, lobes valvate. Stamens inserted in the throat, filaments short. Style filiform, stigma capitate, or indistinctly 2-lobed; ovules numerous, placentas fleshy, adnate to both sides of the dissepiment. Fruit a berry with a shell-like rind, the seeds large, compressed, embedded in a fleshy pulp. Embryo short straight eccentric, in a cartilaginous albumen.

Corolla campanulate, throat bearded; fruit black when ripe, ¾ in. diam., 1-seeded . . . . 1. *S. potatorum.*
Corolla-tube cylindric, many times longer than calyx; fruit orange when ripe, 3-4 in. diam., many-seeded . . . 2. *S. Nux-vomica.*

1. **S. potatorum**, Linn. fil.; Roxb. Cor. Pl. t. 5; Fl. Ind. i. 576; Wight Ill. t. 156.—*The clearing-nut tree.* Sans. *Kataka.* Vern. *Nermali, nirmali, nel-mal.*

A middle-sized tree, evergreen, wholly glabrous; trunk often irregularly fluted. Leaves coriaceous, ovate or rotundate, subsessile, or very shortly petiolate, 2-3 in. long. Flowers white, fragrant, in short pedunculate glabrous cymes, on the previous year's wood, at the base of this year's branchlets. Corolla-tube campanulate, with tufts of white hair at the base of the segments between the stamens. Style cylindric, from a conical base, stigma indistinctly 2-lobed. Berry subglobose, black when ripe, 1-seeded, ¾ in. diam. Seeds compressed, nearly circular.

South India, Bengal, Behar, Bijoragogurh forests, and probably elsewhere in the Centr. Prov. Bark dark-coloured, deeply cracked. Fl. H.S. Wood durable, hard and close-grained. Medullary rays numerous, whitish in darker tissue. Pores in large, irregularly ramified patches of whitish tissue. Pulp of the fruit eaten. The ripe seeds are used to clear muddy water.

2. **S. Nux-vomica**, Linn.; Roxb. Cor. Pl. t. 4; Fl. Ind. i. 575; Bedd. Fl. Sylv. t. 243; Benth. l. c. 103.—Vern. *Kuchla, kajra; Khabaung,* Burm.

A small, slow-growing, evergreen, glabrous tree. Leaves ovate or rotundate, coriaceous, shining, blade 4-5 in., petiole ½ in. long. Flowers greenish white, on terminal pubescent pedunculate, corymbose cymes. Corolla-tube cylindric, 4-5 times longer than calyx, throat glabrous. Style filiform, stigma undivided. Berry as large as an orange, and of the same colour. Seeds flat, grey, shining, circular or reniform.

South India, Burma, Bengal, Gorakhpur forests (D.B.), and probably also in the Centr. Prov. Bark smooth, ash-coloured, young shoots shining, deep green. Wood hard, durable, of a bitter taste. Structure similar to that of *S. potatorum*, but the whitish patches more in concentric lines. Weight 48.75 lb. (D.B. exp. 1864), 56 lb. (Skinner). Value of P. 623 (D.B.), 1120 (Sk.) The seeds contain 0.28-0.53°/₀ of Strychnia, an extremely bitter and most poisonous alkaloid, mixed with Brucia, another alkaloid closely related to it. These substances are also found in the bark of *S. Nux-vomica*, and in the bark and root of several other species of the genus. They seem to constitute the poisonous principle in the *Upas Radja* or *Tieute*, the arrow-poison of the Moluccas, prepared from the root-bark of a climber (*S. Tieute*, Lesch.; Miq. Fl. Ind. Bat. ii. 380). Igasuric acid (similar to Malic acid) is associated with these alkaloids. The orange-coloured pulp of the fruit is eaten by birds.

2. BUDDLEIA, Linn.

Shrubs, with a mealy or woolly tomentum, rarely glabrous. Flowers tetramerous. Corolla-lobes imbricate in bud. Stamens 4, anthers nearly sessile. Capsule opening septicidally in 2 entire or bifid valves, leaving the dissepiment free in the centre. Seeds small, numerous.

Flowers in dense cylindrical leafless spikes; tomentum white or yellowish	1. *B. asiatica.*
Flowers in leafy panicles; tomentum tawny or rust-coloured .	2. *B. paniculata.*

1. **B. asiatica**, Lour.—Syn. *B. discolor*, Roth; Wight Ic. t. 894. *B. Neemda*, Roxb. Fl. Ind. i. 396. Vern. *Bhati*, *dhaula*, *shiūntra*, Kamaon.

A large shrub; branches, inflorescence and under side of leaves covered with a white or yellowish soft tomentum either dense and thick, or more or less mealy. Leaves lanceolate, 3-6 in. long, on a short petiole, entire or serrulate, usually glabrous above. Flowers white, odorous, nearly sessile, in dense cylindrical bracteate erect spikes, often interrupted at the base, either solitary and terminal, or several together at the ends of branches. Corolla-tube pubescent outside, less than twice the length of calyx, lobes rounded, obtuse. Valves of capsule bifid.

A common shrub in South India, Burma, Bengal, Oudh, along banks of nallahs and ravines. In the sub-Himalayan tract extends as far west as the Indus, ascending to 4000 ft. China. Indian Archipelago. Fl. Feb.-April. In most parts of Burma, this and *Blumea* are common shrubs on deserted hill-clearings (Toungyas).

2. **B. paniculata**, Wall.; Roxb. Fl. Ind., ed. Carey, i. 412.—Syn. *B. crispa*, Benth.; DC. Prodr. x. 444. Vern. *Spera wuna*, Afg.; *Dholtu*, *Ghūttia*, N.W. Him. Also known by the names of the preceding species.

A shrub or small tree, with a gnarled and crooked stem; branches woody, bark peeling off in long shreds; branchlets, leaves, and inflorescence densely clothed with soft rust-coloured or tawny tomentum. Leaves extremely variable, from lanceolate, entire, to ovate-triangular, dentate and deeply cut; blade 4-6 in., petiole ½-1½ in. long. Flowers subsessile, white, fragrant, in bracteate, generally pedunculate clusters, forming irregular terminal, leaf-bearing panicles. Bracts linear, generally longer than flowers. Corolla densely tomentose outside, tube cylindrical, twice the length of calyx, lobes rounded, obtuse.

Himalaya, Indus to Bhutan, ascending to 7000 ft. Afghanistan. Beluchistan.

ORDER LIV. **APOCYNEÆ.**

Trees, shrubs, twiners, rarely perennial herbs, the juice frequently milky. Leaves entire, opposite or whorled, very rarely alternate, without stipules, or with small glandlike intrapetiolar or interpetiolar stipules. Flowers regular, usually cymose. Calyx free, divided nearly or quite to the base into 5 segments or sepals, generally imbricate in bud. Corolla hypogynous, gamopetalous, with 5 spreading lobes, contorted, rarely valvate in bud, the throat hairy inside, or closed with a corona of scales. Stamens 5, inserted in the tube, alternating with the corolla-lobes; anthers erect, 2-celled, the cells opening inward in longitudinal slits, the pollen not collected in masses. Pistil dicarpellary; the carpels either distinct below, or united in a 2-celled ovary with axile placentas, or in a 1-celled ovary with parietal placentas; ovules few or more generally numerous; style single or 2 distinct styles; stigma usually thickened. Seeds often bearing a coma or tuft of long hairs, usually albuminous, embryo straight. —Royle Ill. 269; Wight Ill. ii. 160.

- Fruit a fleshy indehiscent berry, generally 1-4-seeded; leaves opposite; spines axillary . . . . . 1. CARISSA.
- Fruit a large subglobose drupe, with hard fibrous endocarp; leaves alternate, crowded at the ends of branches . 2. CERBERA.
- Fruit of 2 many-seeded follicles, distinct from the beginning, or separating when ripe.
  - Seeds naked, angular, embedded in pulp; leaves opposite 3. TABERNÆMONTANA.
  - Seeds naked, winged; leaves alternate, sessile . . 4. RHAZYA.
  - Seeds naked, winged; leaves alternate, petiolate, crowded at the ends of branches . . . . 5. PLUMERIA.
  - Seeds with a tuft of hairs at the lower end—that is, the end opposite the hilum; leaves opposite; stamens exserted . . . . 6. WRIGHTIA.
  - Seeds flat, attached in the middle, with a fringe of hairs all round; and prominent tufts at the ends; leaves whorled . . . . 7. ALSTONIA.
  - Seeds with a tuft of hairs at the hilum—that is, at the upper end; corolla without appendices.
    - A small tree, not climbing; fruit of 2 distinct follicles 8. HOLARRHENA.
    - Climbers; fruit of 2 distinct follicles . . . 9. ICHNOCARPUS.
    - Climbers; fruit a long cylindrical, 2-valved capsule, separating into 2 follicles when ripe.
      - Glabrous; corolla-tube short cylindrical; limb ¾ in. across . . . . 10. VALLARIS.
      - Tomentose; corolla hypocrateriform, limb 2-3 in. across . . . . 11. CHONEMORPHA.
  - Seeds pubescent all over, and with a tuft of hairs at the hilum; a corona of 5 laciniated appendices opposite to the corolla-lobes . . . . 12. NERIUM.

Several plants of this family yield caoutchouc. *Vahea gummifera*, Lam., of Madagascar, and other species of the same genus, produce an excellent article, second only in quality to the Para caoutchouc. They are large climbing shrubs, with huge subglobose fruit. The African caoutchouc, a much inferior article, is likewise produced by large climbing shrubs, which belong to the genus *Landolphia*, with large subglobose fruit containing an acidulous pulp in a hard woody rind. *Urceola elastica*, Roxb.; Wight Ic. t. 473, a gigantic climber (fruit of 2 large globose, many-seeded coriaceous follicles, the seeds embedded in fleshy eatable pulp) of the Indian Archipelago, yields the Borneo rubber, and small quantities of caoutchouc are collected in India from *Willughbeia edulis*, Roxb. Cor. Pl. t. 280, and *W. Martabanica*, Wall. Pl. As. rar. t. 272, two large climbers of Burma and Eastern Bengal.—(Collins' Report on Caoutchouc, 1872.)

Vahea belongs to the sub-Order of *Carisseæ*, with a single 2-celled ovary. *Landolphia* and *Willughbeia* are somewhat anomalous genera with 1-celled ovary, and fleshy fruit. *Urceola* belongs to the sub-Order *Euapocyneæ* (fruit of 2 many-seeded follicles), which comprises all genera described below, except *Carissa* and *Cerbera*.

1. CARISSA, Linn.

Shrubs or trees, often armed with opposite axillary spines. Leaves opposite. Calyx without glands. Corolla-tube cylindrical, slightly swollen round the anthers, lobes spreading, contorted in the bud, the throat without scales. Anthers oblong or lanceolate, included in the corolla-tube. Ovary single, 2-celled; ovules several in each cell; style filiform, stigma thickened. Fruit succulent, indehiscent. Seeds 1-4, rarely more, without hairs, albuminous.

Leaves and branchlets always glabrous; fruit ½-1 in. long, sometimes more than 4-seeded . . . . 1. *C. Carandas*.
Leaves and branchlets often pubescent; fruit ¼ in. long, 4-seeded 2. *C. diffusa*.

1. **C. Carandas**, Linn.; Roxb. Cor. Pl. t. 77; Fl. i. 687; Wight Ic. t. 426.—Syn. *C. congesta*, Wight Ic. t. 1289. Sans. *Karamarda* (the tree), *avigna* (the fruit). Vern. *Karaunda*, *karaun*, *karūnda*, *korinda*, *garinga*. Local n. *Timukhia*, N.W.P.; *Gotho*, C.P.

A large evergreen shrub with a short stem, glabrous, only inflorescence pubescent. Branchlets generally alternate, with twin stout, sharp, often forked, glabrous, shining spines at their base, 1-1½ in. long; branches exceptionally opposite, generally without spines. Leaves coriaceous, generally penninerved, wholly glabrous, and shining on both sides, elliptic ovate or obovate, rarely elliptic-oblong, obtuse or mucronate, 1½-3 in. long, 1-2 in. broad, subsessile or on short petioles. Flowers white, inodorous, on short pedicels in sessile or pedunculate pubescent cymose corymbs of 10-20 flowers at the ends of branches. Bracts linear, pubescent. Calyx pubescent, cleft half-way or deeper into lanceolate ciliate segments. Corolla-lobes lanceolate, shorter than tube, but more than half its length. Ovules 4 in each cell of ovary. Berry ovoid or globose, ½-1 in. long, 4- or more-seeded, shining, first red, black when ripe.

Cultivated in most parts of India, not much in the Panjab; is wild on dry sandy and rocky soil in the Gonda and Baraich divisions of the Oudh forests, Bingah Sāl forests (R. Thompson), in the Gorakhpur district, in Bengal and South India. Foliage generally renewed in March. Fl. Jan.-April; fruit ripens July-Aug. Grows rapidly, and coppices freely.

Stem 3-4 ft. high, 2 ft. girth, sometimes more, branches rigid, divergent, forming a scanty rounded crown. Branchlets reddish-brown, smooth, spreading. Bark ½ in. thick, grey or white with pale-orange streaks, smoothish between longitudinal wrinkles, with brown exfoliating scales. Wood white, close-grained and hard, is an excellent fuel, and has been recommended for turning. Makes excellent fences. The red, half-ripe fruit is made into tarts jellies and pickle. When ripe, it is sold in bazaars and eaten largely.

2. **C. diffusa**, Roxb. Fl. Ind. i. 689; Wight Ic. t. 427.—Vern. *Karaunda*. Local n. *Gān*, *garna*, *garinda*, Pb.

A small evergreen shrub, with rigid, spreading branches; young leaves, branchlets and inflorescence pubescent. Branchlets opposite and single, spines ½-1 in. long, often pubescent and forked, generally at the base of the single branches. Leaves coriaceous, glabrate or pubescent beneath, ovate, acute, mucronate, 1-1½ in. long, ½-¾ in. broad, generally with 1 or 2 pairs of arching basal nerves. Flowers pure white to delicate pink, finely odorous, on short pedicels in sessile or pedunculate cymose corymbs of 2-10 flowers, at the ends of branches. Bracts linear, pubescent. Calyx pubescent, cleft nearly to the base into lanceolate ciliate segments. Corolla-lobes lanceolate, shorter than tube, but more than half its length. Ovules 2 in each cell of the ovary. Berry subglobose, ¼ in. long, 4-seeded, shining, black when ripe, seeds 4.

Abundant wild in most parts of India, in the plains of the Panjab, the sub-Himalayan tract, ascending to 4000 ft., and in the trans-Indus territory, generally gregarious, here and there forming underwood in forests of Bamboo in the Siwalik tract, of *Pinus longifolia* (Kangra), of Teak (Saugor district). Useful by keeping the ground moist and cool under trees with light foliage which do notthrow heavy shade; may be employed in the same way as Beech underwood under Oak or Scotch Fir in Europe. Spreads readily where clearings have been made, and may in such cases impede the reproduction and growth of the forest. Fl. March-May; fruit ripens Oct.-Feb. Very hardy, coppices freely. The wood, though always small, is used for turning and for making combs; it is an excellent fuel. Very old wood is said (in Kangra) to be black and fragrant. The leaves are greedily eaten by goats and sheep, but the chief use of the shrub is to furnish material for dry fences.

The characters available for the distinction of these two species are unsatisfactory and variable, and farther inquiries may possibly show *C. Carandas* to be nothing but the cultivated form of *C. diffusa*.

2. CERBERA, Linn.

Shrubs or trees, with alternate leaves, crowded on the young branches. Flowers large, in terminal corymbose cymes. Calyx without glands. Corolla-tube cylindrical, without scales, lobes spreading, angular, contorted in bud. Anthers included in the corolla-tube, inserted about the middle. Ovary of 2 distinct carpels, united by a single style, each carpel incompletely divided by a very prominent placenta, bearing 2 superposed ovules on each side; stigma conical, often 2-lobed at the tip. Fruit (from the abortion of one carpel) a single drupe, flattened on one side, with a woody or fibrous endocarp, usually 1-seeded. Seeds without hairs.

1. **C. Odollam**, Gærtn.; Roxb. Fl. Ind. i. 692; Wight Ic. t. 441.

A large tree or a shrub, wholly glabrous, with thick branches. Leaves 6-12 in. long, shining, oblong lanceolate or oblanceolate, acuminate, narrowed into petiole 1 - 1½ in. long; main lateral nerves numerous, parallel, at right angles to midrib, joined by indistinct intramarginal veins. Flowers white, sweet-scented, in a corymbose pedunculate cyme. Calyx-segments linear, reflexed, deciduous. Bracts coloured, ½-1 in. long, caducous. Drupe ovoid, 2-4 in. long, endocarp thick, fibrous.

Common in salt swamps on the coast of Bengal, the peninsula and probably of Sindh. A widely spread tree, on the coasts of China, the Indian Archipelago, Queensland, and the Pacific islands. In flower and fruit throughout the year. Wood white, soft, and spongy.

3. TABERNÆMONTANA, Plum.

1. **T. coronaria**, Willd.; Roxb. Fl. Ind. ii. 23; Wight Ic. t. 477; Bot. Reg. t. 1064.—Vern. *Chāndui*, *taggai*, *taggar*.

A shrub, 6-8 ft., glabrous, branches dichotomous. Leaves opposite, elliptic-oblong, acuminate. Flowers white; calyx glandulose inside; corolla-tube cylindrical, slender; ovaries 2 with many ovules, style 1. Fruit of 2 distinct recurved cylindrical follicles, 1-3 in. long. Seeds 3-6, embedded in red fleshy pulp; embryo in a fleshy albumen.

Cultivated in gardens throughout India, with single and double flowers; exceedingly fragrant at night. Wild in Eastern Bengal, Nepal, Kamaon, and in the Konkan. Fl. in the hot and rainy season.

T. utilis, Arnott in Edinb. New Phil. Journ. 1830, i. 318, is a tree in British Guiana, which yields a thick sweet nutritious milk, called Hya-hya by the Indians.

4. RHAZYA, Decaisne.

1. **R. stricta**, Decaisne in Jacquem. Voy. Bot. t. 111.—Vern. *Vena*, Salt range; *Gandera*, Trans-Indus; *Sewar*, *sihar*, *ishwarg*. Sindh.

A small glabrous shrub. Leaves alternate, linear-oblanceolate, mucronate, sessile. Flowers white, odorous, corolla-tube cylindrical, much longer than lobes; ovary 2-celled, with numerous ovules. Fruit of 2 distinct erect cylindrical follicles. Seeds numerous, flat, with membranous wings at the two extremities; embryo straight, in a fleshy albumen.

Abundant in the trans-Indus territory, between Indus and Jhelam, and in Sindh. Afghanistan, Beluchistan, and Arabia. Fl. April. Used as fuel. The leaves, after steeping for some days, are fodder for goats. The fruit (*Sanwar*) and the leaves are used in native medicine.

5. PLUMERIA, Tourn.

Shrubs or trees, with alternate leaves, crowded at the ends of branches. Flowers large, in terminal corymbose cymes. Calyx small, without glands. Corolla-tube cylindrical, without scales, lobes spreading, contorted in bud. Anthers inserted at the base of the corolla-tube, round the ovary. Ovary of 2 distinct carpels, united by a single style, ovules numerous; style short, thick, with a 2-lobed stigma. Fruit of 2 follicles with numerous compressed, winged, hairless, albuminous seeds. Cotyledons flat, foliaceous.

1. **P. acutifolia**, Poiret.—Syn. *P. acuminata*, Roxb. Fl. Ind. ii. 20; Wight Ic. t. 471. Vern. *Gula chīn*, Hind.; *Khair champa*, Bomb.

A small tree, wholly glabrous, with thick branches, and rough bark, full of tenacious, white juice. Leaves lanceolate or oblanceolate, 6-15 in. long, narrowed into a petiole 1-2 in. long; main lateral nerves numerous, transverse, parallel, joined by prominent intramarginal veins. Flowers in large compound, pedunculate cymes, white, fragrant, pale yellow in the centre. Follicles divaricate, rigid, drooping, 6 in. long.

Cultivated throughout India and Burma, near villages, temples, and in gardens, but not indigenous. Cultivated in Siam, China, Cochin China, and the Indian Archipelago (Rumph. Amb. iv. t. 38). Its home is not known. It grows in New Grenada and other parts of tropical America, but whether indigenous, is uncertain. (The other Plumerias inhabit tropical America, and *P. loranthifolia*, Müll.; Mart. Flora Brasiliensis, vi. p. 42, a closely allied species, is found in Para and Matto-Grosso.) Fl. H. and R. S. Ripens its fruit very rarely. Attempts have been made to make caoutchouc of the milk, but without success.

6. WRIGHTIA, R. Brown.

Trees or shrubs, with opposite leaves. Flowers in terminal corymbose cymes. Calyx with 5-10 broad scales inside at the base. Corolla-tube cylindrical, generally short; lobes spreading, before expansion twisted towards the right, the throat with a corona of 5 or 10 erect scales, either distinct or united in a ring. Stamens inserted in the throat, filaments short and broad, continued into a broad, tapering connective; anthers exserted, sagittate, connivent in a cone round the stigma, and often adhering laterally. Ovary of 2 carpels, distinct or connate, with numerous ovules in each, multiseriate, on axile placentas. Fruit long-cylindrical, separating into two follicles dehiscing on the inner face, filled with numerous oblong pendulous seeds, each with a tuft of long silky hairs at the lower end. Albumen none, embryo cylindrical, cotyledons convolute, longer than superior radicle.

Follicles connate into a long cylindrical capsule, separating and dehiscing at the same time; leaves soft tomentose . .	1. *W. tomentosa.*
Follicles distinct, cohering at the apex only; leaves rough . .	2. *W. tinctoria.*

1. **W. tomentosa**, Roem. et Schultes; Wight Ic. t. 443.—Syn. *W. mollissima*, Wall. Pl. As. rar. t. 146; Wight Ill. t. 154. *Nerium tomentosum*, Roxb. Fl. Ind. ii. 6. Vern. *Keor*, *kilāwa*, Pb. *Dhūdī*, N.W.P.,

Oudh. Local names: *Dharauli, darhela, daira,* Garhw.; *Lettaukthein,* Burma.

A small tree, branchlets and leaves clothed with soft tomentum. Leaves elliptic, acuminate, narrowed into a short petiole, 3-4 in. long; main lateral nerves parallel, 8-12 pair. Flowers 1 in. across, in subsessile, stiff, erect, corymbose and tomentose cymes, with oval deciduous bracts. Corolla-tube twice the length of calyx, lobes oblong, yellowish, corona fleshy, orange-coloured, cleft into unequal oblong lobes. Anthers white. Fruit subcylindrical, laterally compressed, 8-12 in. long, ½ in. across, rough with numerous white elevated specks, with two shallow black furrows at the junction of the carpels, the carpels separating when ripe; hairs of seed pure white.

Sub-Himalayan tract and outer ranges, ascending to 3500 ft. or more (Benārgād, Jaunsar Bawar, D.B.), as far west as the Bias, and very rare beyond it to the Indus. Oudh, Bengal, Central and South India. Ceylon and Burma. Often associated with Sāl, but more commonly in mixed forests. The leaves are shed Feb.-March, the new foliage appears April-May. Fl. April-June; fr. Nov.-Jan.

Attains 20-25 ft., with a short irregular trunk 3, rarely 4 ft. girth. Branches scabrous, with small light-coloured specks. Bark ½ in. thick, light or dark cinereous, corky, inner substance whitish, compact. Wood yellowish white, even- and fine-grained, not hard, easy to work, heartwood not distinct. Weight 33.75 lb., value of P. 523 (Kyd). Used in turning, carved into bowls, plates, and combs (Saharunpur). The bark of stem and root are administered against snake-bites and the sting of scorpions. Abundant yellow milky juice flows from incisions, containing a yellow colouring matter (Roxb.)

There is some uncertainty regarding the colour of the corolla. Wallich (Nepal, Oudh, Kamaon) and Wight describe and figure *W. mollissima* with yellow flowers tinged with red, and Thwaites (Enum. Zeyl. 193) describes *W. tomentosa* in the same manner. Roxburgh says—flowers white, nectary (corona) orange-coloured; Voigt (Hort. p. 525)—yellowish-white, with an orange-coloured throat; and Graham (Bombay Plants, 114)—white. Do the flowers change colour during the day? According to Wallich, the flowers of *mollissima* are inodorous; Voigt describes them as faintly smelling of rhubarb; and J. L. Stewart "as scenting the forest." It is not impossible that a distinct species with white flowers may yet be discovered; and it should be added that *W. Wallichii,* A. DC., Wight Ic. t. 1296, which is otherwise exceedingly like *W. tomentosa,* is described with white flowers.

2. **W. tinctoria,** R. Br.; Bedd. Fl. Sylv. t. 241.—Syn. *W. Rothii,* G. Don; Wight Ic. t. 1319. *Nerium tinctorum,* Roxb. Fl. Ind. ii. 4. Vern. *Dhūdi,* Banda; *Khirni,* Meywar. (Seeds *Indarjau, indrajau.*)

A small tree; branchlets yellow or light brown, extremities and leaves glabrous or pubescent. Leaves elliptic-oblong, 3-4 in. long, acuminate, base rounded, petiole very short; main lateral nerves 8-10, arching, joined by intramarginal veins. Flowers white, in lax terminal cymes with slender spreading branches. Corolla-tube twice the length of calyx. Corona of numerous linear scales, varying in length, some inserted with the filaments, others on the corolla-lobes. Fruit of 2 distinct pendulous, slender follicles, 10-20 in. long, cohering at the top only, with elevated longitudinal lines, otherwise smooth. Var. *α. tinctoria;* glabrous. *β. Rothii;* pubescent, leaves rough when old.

Common in the Peninsula, ascending to 4000 ft. (*a* and *β*). From Central India *β* only, with rough leaves, is known. Bassi forests in Meywar, Nagpahar between Ajmir and Pokur (D.B.); Banda, Edgeworth. Leaves are shed Feb., reappear in March-April, with the flowers. Fruit ripens ensuing C.S. Wood pure white, close- and even-grained, valued highly for turning and carving. The leaves yield Indigo (Roxb.) The seeds are sold as the sweet (*mitha*) *indarjau* in the bazaars; they are not bitter.

W. coccinea, Sims. Bot. Mag. t. 2696; Wight Ic. t. 442; a large tree with dark-crimson flowers, 2 in. across, solitary 3 or 6 together, from the Kasia hills, is occasionally grown in gardens in Northern India. Wood white, light, but firm, used for palkees.

7. ALSTONIA, R. Brown.

Trees, rarely shrubs; leaves entire, verticillate or opposite. Calyx without scales or glands. Corolla-tube cylindrical, lobes spreading, shorter than tube, twisted towards the right before expansion. Corona wanting. Stamens included, inserted half-way up the tube, or higher. Ovary of 2 distinct carpels, united by the style; stigma thickened; ovules numerous. Fruit of 2 distinct long linear follicles. Seed oblong, compressed, peltate, the edge with a dense fringe of long hairs all round; albumen scanty, radicle superior, cotyledons oblong, flat.

1. **A. scholaris,** R. Brown; Wight Ic. t. 422; Bedd. Fl. Sylv. t. 242. —Syn. *A. cuneata,* Wall. Sans. *Ayugma, chhada, ayuk chhada.* Vern. *Chatiūn, satiūn, chutian, satwīn, satni* (*Taunmayoben,* Burm.)

A large tree, with bitter milky juice; glabrous, inflorescence only pubescent. Leaves coriaceous, shining above, opaque and pale underneath, in whorls of 5-7, oblong or obovate-oblong, obtuse, rarely acute, 4-8 in. long, narrowed into a short petiole; main lateral nerves numerous, parallel, transverse. Flowers greenish-white, sessile or shortly pedicellate, in compact many-flowered pedunculate cymes. Peduncles 1-2 in. long; cymes 8-12 arranged in a pedunculate umbel, and the umbels forming whorls in the axils of the terminal whorl of leaves. Calyx and corolla pubescent. Follicles slender, numerous, in hanging clusters.

Sub-Himalayan tract, extending west to the Jumna, and ascending to 3000 ft. Scarce in the Oudh forests. Bengal, western side of the Peninsula, Burma, Ceylon, Indian Archipelago, Queensland, tropical Africa. Fl. Dec.-March; fruit June. Growth apparently rapid.

Attains 40-60, at times 80-90 ft., with a tall stem, often with a fluted or buttressed base, and spreading branches in tiers of whorls. Bark dark grey, rough, but not cracked. Wood whitish, even-grained, somewhat porous and open, soft and light, 40 lb. per cub. ft. Easily worked; used for furniture, boxes, scabbards, school-boards, and for beams in Assam. Wood and bark are bitter; the bark is officinal as an astringent tonic, anthelmintic, and antiperiodic (Pharm. Ind. 137).

8. HOLARRHENA, R. Brown.

Shrubs or trees with opposite entire leaves. Calyx-lobes lanceolate, with glands inside at their base. Corolla-tube cylindrical, more or less swollen above its base round the anthers, lobes spreading, twisted to the left before expansion. Corona wanting. Stamens included, inserted below the middle of the tube. Ovary of 2 distinct carpels, united by the style; stigma oblong, not thickened; ovules numerous. Fruit of 2 distinct long slender follicles. Seeds numerous, pendulous, with a tuft of long hairs at the hilum; radicle superior, shorter than the auriculate, plaited and involute cotyledons; albumen none.

1. **H. antidysenterica**, Wall.—**Tab. XL.**—Syn. *H. pubescens*, Wall. *H. Codaga*, G. Don; Wight Ic. t. 1297. *Echites antidysenterica*, Roxb. *Chonemorpha antidysenterica*, G. Don; Wight Ic. t. 439. Vern. *Karra, kaura, kora, kūra, kūar, keor, kūer, kari, dhūdi, dhōdi.* Local names: *Kogar, kiam*, Pb.; *Kachri*, Oudh; *Samōka marra*, Gonds of Seoni; *Ankria*, Bheels of Banswara. (Seeds: *Karwa* (bitter) *indarjau.*) *Lettauk*, Burm.

A small tree, glabrous or pubescent. Leaves 6-12 in. long, subsessile, elliptic-oblong, short-acuminate, base obtuse; main lateral nerves 10-14 pair, joined by prominent transverse veins. Flowers white, inodorous, 1-1¼ in. across, on slender pedicels, in sessile terminal corymbose cymes, with small lanceolate, ciliate bracts. Corolla-tube slender, many times longer than calyx, lobes nearly as long as tube. Follicles smooth, 8-15 in. long, ⅕ in. diam. Seeds narrow-oblong, ½ in. long, brown, bitter, hairs silky, twice the length of seed. Var. *α. glabra;* leaves glabrous on both sides. Var. *β. pubescens;* leaves soft tomentose beneath.

Sub-Himalayan tract, ascending to 3500 ft., and extending westward to the Chenab. Oudh, Bengal, Central and South India. Banswara forests, but not found in the more arid parts of Rajputana. Often associated with Sāl, in Burma in the *Ein* forest of *Dipterocarpus tuberculatus*, Roxb. Old leaves shed Feb., the new foliage appears April-May. Fl. April-June; fruit ripe in the cold season, generally bursting in March or April.

Attains 20-30 ft., trunk short, straight, rigid and furrowed, 3-4 ft. girth. Bark ½ in. thick, brownish-grey or blackish, warty, with some longitudinal cracks, and exfoliating in thick woody scales. Foliage bright pea-green. Wood white, tinged with yellow or pink, even- fine- and smooth-grained, soft and light, heartwood not distinct. Weight 37-38 lb. Value of P. 417 (Kyd), 562 (Skinner), 811 (*Lettauk*, Benson). Easy to work, carved into tobacco-boxes, toys, combs, spoons, forks, and platters. In Assam, where the tree grows to a larger size, furniture is made of it. The bark (*conessi*, formerly an article of trade), leaves, fruit, and seeds, are used medicinally (Pharm. Ind. 137); the flowers are gathered for ornaments at marriages, and the leaves are employed as fodder or litter.

9. ICHNOCARPUS, R. Brown.

Climbers with opposite leaves. Calyx 5-cleft, with small glands inside at the base of the lobes. Corolla hypocrateriform, without appendices; lobes hairy inside, convolute in bud. Fruit of 2 distinct, many-seeded, slender follicles. Seeds not rostrate, with a tuft of hair at the hilum.

Flowers in compact cymes, forming elongated panicles; corolla-tube barely ⅙ in. long	1. *I. frutescens.*
Flowers in lax pedunculate corymbose cymes; corolla-tube ⅓ in. long	2. *I. fragrans.*

1. **I. frutescens**, R. Brown; Wight Ic. t. 430.—Syn. *Echites frutescens*, Roxb. Fl. Ind. ii. 12. Vern. *Dudhi*, Kamaon.

A twining shrub; branchlets, inflorescence and under side of leaves with rust-coloured pubescence. Leaves opposite, petiolate, ovate-lanceolate, acuminate. Flowers small (white, inodorous, Roxb., greenish white, sweet-scented, Voigt Hortus, 523), on short pedicels, in compact short, trichotomous, pedunculate cymes, forming elongated leafy panicles. Calyx with small basal glands. Corolla hypocrateriform, tube barely ⅙ in. long, lobes lanceolate, twisted, hairy along the upper face. Ovaries distinct, surrounded by 5 distinct hypogynous scales, as long as ovaries; style 1. Fruit of 2 distinct linear, slender follicles, 2-3 in. long. Seeds numerous, pendulous, a long tuft of hairs at the hilum.

South and Central India, Bengal, Burma. In north-west India known to extend as far west as Delhi in the plains, and to the Sutlej in the sub-Himalayan tract. Indian Archipelago and Queensland. The root has been used as a substitute for sarsaparilla.

2. **I. fragrans**, Wall.; DC. Prodr. viii. 435.—Syn. (probably) *Blaberopus lucidus*, A. DC.; *Alstonia lucida*, Don Fl. Nep. 131. Vern. *Dudhi*, Kamaon.

A climbing shrub; glabrous, but branchlets, petioles and under side of leaves often hairy. Leaves opposite, subcoriaceous, shining above, elliptic-oblong, acuminate, blade 4-5 in., petiole ¼ in. long. Flowers on slender pedicels, in lax compound trichotomous pedunculate glabrous corymbose terminal and axillary cymes. Corolla-tube ⅓ in. long, 2-thirds of its length narrow-tubular, suddenly widened above into a campanulate mouth; lobes oblong, nearly as long as tube, hairy on the upper side near the base. Fruit of 2 distinct linear follicles, about 6 in. long, with numerous pendulous seeds, not rostrate, a tuft of hairs at the hilum.

North-West Himalaya, Kashmir to Nepal, ascending to 6000 ft. Bhutan, Assam. Fl. April-June. Somewhat similar to *Parechites Thunbergii*, A. Gray (*Rhynchospermum jasminoides*, Lindl.), from Japan and China.

10. VALLARIS, Burm.

1. **V. dichotoma**, Wall.; Wight Ic. t. 438.—Syn. *Echites dichotoma*, Roxb. Fl. Ind. ii. 19. Vern. *Dudhi*, Kamaon.

A large twining shrub; bark ash-coloured, glabrous, inflorescence only pubescent. Leaves opposite, petiolate, elliptic-oblong, acuminate; a circle of small cylindric glands at the insertion of the leaves. Flowers white, fragrant, on slender pedicels, in axillary, 3-10-flowered cymes. Corolla-tube short, cylindrical, limb large, spreading, ¾ in. across. Ovary

1, 2-celled, surrounded at the base by a 5-fid ciliate, cup-shaped nectary; style filiform pubescent; ovules numerous. Fruit large, oblong, 2-celled, valves thick fibrous. Seeds numerous pendulous, with a tuft of hairs at the hilum, radicle superior; albumen scanty.

South India, Bengal, and Central India. Burma and Ceylon. In the sub-Himalayan tract west to the Ganges. Cultivated in gardens. Fl. Dec.-April.

11. CHONEMORPHA, G. Don.

1. **C. macrophylla**, G. Don; Wight Ic. t. 432.—Syn. *Echites macrophylla*, Roxb. Fl. Ind. ii. 13. Vern. *Gar badero*, Kamaon.

A large climbing milky shrub. Leaves opposite, large, rotundate or obovate, 8-12 in. long, 6-9 in. broad, tomentose beneath. Flowers large, white, fragrant, coriaceous, in terminal corymbose pedunculate cymes; bracts large ovate, deciduous. Calyx with glands inside at the base. Corolla hypocrateriform, limb 2-3 in. across. Ovaries two distinct, surrounded by a cup-shaped thick nectary, style 1. Capsule long, pendulous, 12 in. long, quadrangular, 2-valved. Seeds numerous compressed pendulous, narrowed into a short beak above, and bearing a tuft of long white silky hairs; albumen scanty, radicle superior.

South India, Bengal, Nepal and Kamaon, Burma, Ceylon, and Indian Archipelago. Fl. April-Sept. The milk is said to yield a kind of caoutchouc.

12. NERIUM, Linn.

Shrubs with white milk. Leaves entire, coriaceous, opposite or whorled. Flowers large, in terminal cymes. Calyx-lobes with numerous fleshy linear glands at their base inside. Corolla-tube short, turbinate or campanulate, lobes spreading, unequal-sided; corona of laciniated appendices opposite to the lobes. Anthers sagittate, on short broad filaments, continued beyond the anthers into a long hairy tail-like appendix, thickened and contorted at the top. Ovary of 2 carpels, more or less cohering, style 1, stigma shaped like a truncate cone. Fruit a cylindrical capsule when ripe, dehiscing septicidally into 2 many-seeded follicles. Seeds pendulous, tomentose all over and with a tuft of hairs at the hilum; albuminous, radicle superior.

1. **N. odorum**, Solander; Roxb. Fl. Ind. ii. 2; Bot. Mag. t. 2032.—Sans. *Karavira*; Pers. *Kharzahra*. Vern. *Kanīra, kaner, ganīra, ganhīra*, Pb.; *Kaniyūr*, Kamaon.

A large glabrous shrub. Leaves in whorls of 3, linear-lanceolate, 4-6 in. long, narrowed into a short petiole, under surface uneven and irregularly pitted, midrib very prominent, main lateral nerves numerous, parallel, transverse. Flowers scented, rose-coloured white or red; appendices of corona cleft into numerous filiform segments, or trifid, the lateral segments linear, the centre one short-triangular. Fruit linear, 6-9 in. long.

Common in North-West and Central India, Sindh, Beluchistan and Afghanistan. Ascends to 5500 ft. in the outer Himalaya. Generally along the sides of rocky stream-beds or in ravines and river-beds which are dry in winter. Cultivated in gardens throughout India, with single and double flowers. Fl. April-June, often nearly throughout the year. Bark and root are poisonous; the leaves are used in native medicine (Pharm. Ind. 139).

N. Oleander, Linn., a common shrub in the Mediterranean region and Syria, grows abundantly in similar localities, and under similar conditions, with this difference, that round the Mediterranean the ravines are filled by the winter rains, and are dry in summer. The flowers are inodorous, the segments of the corolla appendices are short, irregular, and not linear or filiform, and the fruit is only 3-6 in. long. The shape of the corolla varies, and does not afford reliable distinctive characters. Other differences I am unable to indicate. Linnæus united them under *N. Oleander*. I am inclined to think that there are intermediate forms, and that the Indian shrub will eventually be replaced under that species.

ORDER LV. ASCLEPIADEÆ.

Perennial herbs or shrubs, often climbing, with opposite entire leaves, and regular pentamerous flowers. Calyx free, divided nearly or quite to the base into 5 segments or sepals, imbricate in bud. Corolla-tube generally short, the lobes contorted or valvate in bud. Stamens 5, inserted at the base of the corolla, and alternating with the corolla-lobes, the filaments short, connate or rarely free, the anthers always connate into a tube, enclosing the style, and the connective more or less prolonged. A corona of variously shaped distinct or connate appendages alternating with the corolla-lobes is usually inserted upon the corolla-tube, or upon the back of the filaments or wanting. Stamens 5, alternating with the corolla-lobes, inserted at the base of its tube; filaments usually connate, anthers 2-rarely 4-celled; pollen granular or usually cohering in masses, the masses pendulous erect or horizontal, sessile or stipitate, united in pairs to the stigma. Pistil dicarpellary; carpels distinct below; ovules attached to the inner angle; styles united above the ovaries, and thickened within the staminal-tube into an angular body. Fruit of 2 follicles, or of 1 only, by the abortion of the second carpel. Seeds usually pendulous, with a long silky tuft of hairs at the hilum; albumen thin, embryo straight, cotyledons foliaceous, radicle short, superior.—Royle Ill. 272; Wight Ill. ii. 164.

Filaments free; appendages of corona short, fleshy, not aristate	1. CRYPTOLEPIS.
Filaments free; appendages of corona long-aristate . . .	2. PERIPLOCA.
Filaments connate in a staminal tube; pollen-masses 10, stipitate.	
Appendages of corona laterally compressed; follicles broad, semiovate	3. CALOTROPIS.
Appendages of corona flat; flowers in axillary cymes . .	4. MARSDENIA.
Appendages of corona flat; flowers in interpetiolar cymes .	5. PERGULARIA.
Appendages of corona wanting; a leafless shrub . . .	6. ORTHANTHERA.

1. CRYPTOLEPIS, R. Brown.

Corolla-lobes linear, contorted in bud, longer than the tube. Corona of 5 fleshy oblong obtuse appendages included within the tube. Stamens included; filaments short, free, anthers broad-sagittate, with a tuft of hairs at the back, adhering at the base to the edge of the stigma, otherwise free; pollen granular. Fruit of 2 divaricate, ovoid-lanceolate follicles.

1. **C. Buchanani,** Roem. & Schult.; Falconer in Linn. Trans. xix. p. 53, t. 5.—Syn. *Nerium reticulatum,* Roxb. Fl. Ind. ii. 8. Vern. *Karanta.*

A large twining shrub, abounding with milky juice. Leaves oblong or obovate-oblong, pale beneath, obtuse and mucronate, or suddenly acuminate, blade 3-6 in., petiole ¼ in. long; main lateral nerves numerous, transverse, parallel, alternating with shorter ones, with anastomosing intramarginal veins. Flowers small yellow, on short pedicels, in pedunculate axillary cymes, shorter than leaves. Bracts ovate-lanceolate. Follicles 2-3 in. long.

North-West India, plains and sub-Himalayan tract (ascending to 4000 ft.), not known west of the Sutlej. Nepal, Behar, Bengal, South India and Ceylon. Fl. May-June.

2. PERIPLOCA, Linn.

Corolla rotate, lobes ovate, longer than the tube, generally hairy on the upper surface. Corona of 5 short thick appendages, each terminating in a long filiform arista. Filaments short, free, anthers oblong, cohering laterally, with a tuft of hairs at the back; pollen-grains cohering in fours. Follicles divaricate.

Leaves minute or wanting	1. *P. aphylla.*
Leaves lanceolate, long acuminate, 2-3 in. long . .	2. *P. calophylla.*

1. **P. aphylla,** Dne. in Jacq. Voy. t. 116.—Vern. *Barrarra, barre,* Trans-Indus and Sibsagar Doab; *Bāta,* Jhelam and Chenab.

A shrub, with erect leafless stems, glabrous or extremities pubescent, now and then with a few small thick ovate leaves. Flowers small, dark purple, sweet-scented, in short lateral rounded cymes, the corolla-lobes hairy above. Follicles on short thick peduncles, divaricate, cylindrical, gradually tapering, 3 in. long.

Common in many places trans-Indus and Sindh. Salt range, outer Himalaya, eastward to the Chenab, ascending occasionally to 3500 ft. Afghanistan, South Persia, Arabia, Egypt. Eaten by goats, used as fuel; the flower-buds are sweet, and are eaten, raw or cooked, as a vegetable. Fl. March, April.

2. **P. calophylla,** Falconer; DC. Prodr. viii. 498.

A small shrub, wholly glabrous. Leaves shining, lanceolate, long-acuminate, 2-3 in. long, on short petioles; main lateral nerves numerous, parallel, transverse, anastomosing by oblique veins. Flowers small, red, in short axillary, generally opposite rounded cymes; appendages hairy; corolla-segments ciliate. Follicles drooping, parallel, 3-6 in. long.

Outer ranges of the Himalaya westward to the Jumna, and ascending to 5000 ft. Kasia hills. Fl. March, April.

3. CALOTROPIS, R. Brown.

Corolla-tube broad-campanulate, lobes ovate. Stamens connate. Corona of 5 laterally compressed fleshy appendages, adnate to the back of the staminal tube, the lower end free and incurved. Anthers continued into a broad membranous appendix, incumbent on the stigma; pollen-masses 10, pendulous, in pairs, flat, stipitate. Stigma pentagonous. Follicles broad, semiovate.

Corolla somewhat saccate at base, segments spreading, appendages of corona truncate at apex; flower-buds ovoid	1. *C. gigantea.*
Corolla-segments erect; appendages of corona acute at apex; flower-buds hemispherical	2. *C. procera.*

1. **C. gigantea,** R. Br.; Wight Ill. t. 155—Syn. *Asclepias gigantea,* Roxb. Fl. Ind. ii. 30. Sans. *Arka.* Vern. *Madār, safed-ak,* N.W.P.

Young shoots, inflorescence, and under side of leaves covered with soft white adpressed woolly tomentum. Leaves 4-8 in. long, obovate or obovate-oblong, short-acuminate, sessile or subsessile, with a narrow, cordate, often amplexicaul base. Flowers purplish-lilac or white, inodorous, with a grey down outside, on pedicels twice their length, in axillary pedunculate corymbs; flower-buds ovoid; corolla-lobes spreading or reflexed. Appendages of corona elongated, longer than staminal column, their length twice or more than twice their breadth, always hairy.

Common in South and Central India, Burma and Bengal. Gorakhpur, Oudh, and in great profusion in an isolated locality in the Siwalik tract near Kalidungi, below Naini Tal. Ceylon and Indian Archipelago. One of the most common plants in dry waste places. Fl. nearly throughout the year. A large shrub, with thick herbaceous branches, stem 12-18 in. girth, bark thick, soft, ash-coloured, wrinkled.

A fine strong silky flax from the inner bark was formerly made into cloth for princes and nobles. Used for bow-strings, fishing lines and nets; does not easily rot in water. The hair of the seeds is said to be made into thread in Borneo; attempts to weave it have been made in Madras. Gunpowder charcoal is made of the young branches in Kattiawar and in the Dekkan. All parts of the plant are full of acrid milk, which has powerful medicinal qualities.

2. **C. procera,** R. Br.; Ham. in Linn. Soc. Trans. xiv. 246.—Vern. *Spalwakka,* Afg.; *Ak, āk, mudār,* North India.

Young leaves hoary, glabrous when full-grown, inflorescence clothed with white woolly tomentum. Leaves 4-9 in. long, thick, subcoriaceous, ovate obovate or obovate-oblong, acute, sessile or subsessile, with a cordate base. Flowers purplish red, pale silvery outside, with a strong, not unpleasant smell, on pedicels twice their length, in terminal and axillary corymbose cymes. Flower-buds hemispherical; corolla campanulate, lobes erect. Appendages of corona broad, not longer than staminal column, nearly as broad as long, glabrous, rarely pubescent.

Common in the Panjab, Sindh (in places), the trans-Indus territory, ascending to 3500 ft., in the sub-Himalayan tract to the Sardah river, between Indus and Jhelam, ascending to 2400 ft., Oudh, Central India, and the Dekkan. Syria, Arabia, Egypt, Abyssinia, Persia, Afghanistan, and Beluchistan. In a general way it may be said that *C. gigantea* belongs to the moister, *C. procera* to the more dry districts. Often gregarious in dry sandy places. Never quite bare of leaves. Fl. Feb.-May; fruit ripens in the ensuing cold season. Near this plant, and growing on its roots, is frequently seen, pushing through the sand, *Phelipæa Calotropidis*, Walp., a beautiful Orobanchaceous parasite with leafless succulent stems, 2-3 ft. high, terminating in purple flower-spikes.

Generally a shrub 6-7 ft. high, but in the most arid parts of the Panjab may be seen in close clumps 12-15 ft. high, with stems 12-18 in. girth. In Sindh stems 4-5 ft. girth have been observed (Stewart Pb. Pl. 144). Bark $\frac{1}{2}$ in. thick, soft, corky, spongy. Wood white and light, charcoal is made from it, the roots are employed as tooth-brushes. In Sindh the bark is stripped off green, and made into halters, lines, and nets. In Arabia a soft rope is made of the fibre. The silky hair of the seeds is excellent for stuffing pillows and quilts. The plant abounds in acrid milk; mixed with salt, it is used to remove the hair from hides. The dried and powdered root-bark is officinal under the name of *Mudār*, as an alterative tonic, diaphoretic, and in large doses emetic (Pharm. Ind. 141); the supposed active principle has been called Mudarine, a bitter, not crystalline subtance, soluble in water, the solution coagulates when heated, composition unknown.

4. MARSDENIA, R. Brown.

Corolla generally campanulate, limb spreading, divided into 5 lobes, contorted in the bud. Corona of 5 appendages, generally flat, sometimes auriculate, adnate to the back of the staminal column, sometimes 10 appendages in 2 rows. Anthers terminating in a membrane, free, or only adhering laterally; pollen-masses 10, erect, in pairs, stipitate. Style obtuse or rostrate.

Appendages of corona in one series, lanceolate or linear, as long as or longer than stamens. Style obtuse, not rostrate.

  Corolla quite glabrous, except a ring of erect hairs which closes the throat; corolla-lobes shorter than tube; leaves drying with a blue colour . . . . 1. *M. tinctoria.*

  Corolla hairy outside; lobes longer than tube.

    Corolla-lobes glabrous inside; appendage of corona lanceolate, as long as stamens . . . . 2. *M. tenacissima.*

    Corolla-lobes hirsute inside; appendage of corona linear, longer than stamens . . . . 3. *M. Roylei.*

Appendages of corona biseriate, the outer fleshy, attached to the base of staminal column, and shorter than anthers, the inner attached half-way up, membranous, obtuse, shorter than anthers; style terminating in a long filiform beak, as long as corolla . . . . 4. *M. lucida.*

1. **M. tinctoria**, R. Br.; Wight Ic. t. 589.—Syn. *Asclepias tinctoria*, Roxb. Fl. Ind. ii. 43.

A large twining shrub; branches, petioles and peduncles clothed with short down. Leaves pubescent when young, afterwards glabrate, turning blue when dry, ovate, with rounded or cordate base, acuminate, penninerved, blade 4-9 in. long, petioles $\frac{1}{2}$-2 in. Flowers numerous, small, yellow, $\frac{1}{12}$ in. long; pedicels slender, twice the length of flower, in dense umbellate clusters, forming cylindrical, pedunculate, axillary racemes, interrupted at the base. Calyx ciliate. Corolla glabrous, save a ring of hairs in the throat, lobes shorter than tube; appendages of corona lanceolate, as long as stamens. Follicles lanceolate, covered with long soft hairs, reflexed, in racemes of 4-8.

East Bengal, Sikkim, ascending to 3000 ft. Burma. Banda district (Edgew.) Fl. hot and rainy season. The leaves yield a kind of Indigo.

2. **M. tenacissima,** Wight et Arn.; Wight Ic. t. 590.—Syn. *Asclepias tenacissima,* Roxb. Fl. Ind. ii. 51; Cor. Pl. t. 240.

A large twining shrub; branches, leaves and inflorescence soft-tomentose. Leaves cordate, acuminate, 4-6 in. long and 3-4 in. broad, petiole 2-4 in. long, basal nerves 3-5. Flowers greenish-yellow, ⅙ in. long, on slender pedicels, somewhat longer than flowers, in axillary drooping pedunculate compound cymes. Calyx and corolla hairy outside; corolla-lobes longer than tube, glabrous inside. Appendages of corona lanceolate, as long as stamens. Follicles ovate-lanceolate, 4-6 in. long, downy.

Behar, Baraitch forests of Oudh, Kamaon, ascending to 4500 ft. Banda district. Ceylon. Fl. April; fr. in the ensuing cold season. The bark of young luxuriant shoots yields a large quantity of beautiful fine silky fibre, with which the mountaineers of Rajmahal make their bow-strings, on account of its great strength and durability. The following comparative experiments are recorded by Roxburgh:—

A line of *common hemp* broke with 158 lb. when dry, and 190 lb. when wet.
Boehmeria tenacissima „ 240 „ „ „ 278 „ „
Marsd. tenacissima „ 248 „ „ „ 343 „ „

A milky juice exudes from wounds, thickening into an elastic substance very much like caoutchouc, which rubs out black pencil-marks.

3. **M. Roylei,** Wight.—Vern. *Pathor,* Chenab; *Tar, veri,* Salt range; *Murkīla,* Kamaon.

A large twining shrub; branches, under side of leaves, and inflorescence soft-tomentose. Leaves ovate from cordate base, acuminate, 3-5 in. long, petiole 1-2 in. Flowers orange, ⅙ in. long, in compact, rounded, pedunculate axillary cymes. Calyx hairy outside; corolla-lobes longer than tube, hirsute inside. Appendages of corona linear, longer than stamens.

Salt range, Panjab, and outer ranges of N.W. Himalaya, ascending to 7000 ft. Simla, Mussoori, Kamaon. Fl. May, June. The fibre is made into fishing-lines.

4. **M. lucida,** Edgew. MS. in Hb. Kew; Madden in Journ. As. Soc. xvii. pt. i. 370.—Vern. *Dudhi,* Kamaon.

A large evergreen climber; glabrous, only extremities and inflorescence pubescent. Leaves ovate, pale beneath, penniveined, 4-5 in. long, petiole 1-1½ in. Flowers purple, sweet-scented, ¼-⅓ in. long, on pedicels somewhat longer than flower, in short-pedunculate umbelliform cymes. Calyx hairy outside, corolla-lobes longer than tube, hairy. Appendages of corona 10, in a double series, the outer inserted at the base of the staminal tube, thick, fleshy, the inner half-way up, obtuse, membranous, both shorter than anthers. Style prolonged into a filiform beak as long as corolla. Follicles lanceolate, smooth, 5 in. long.

East Bengal, Baraich forests of Oudh, Kamaon (in shady valleys), ascending to 7500 ft. Fl. Oct.-Nov.

5. PERGULARIA, Linn.

Flowers in interpetiolar cymes. Corolla hypocrateriform, limb spreading, lobes contorted in bud. Corona of 5 flat, membranous appendages, adnate to the base of the staminal column, with a small ligula inside below the apex. Anthers connate, terminating in a membrane. Pollen-masses 10, stipitate, erect, in pairs. Style not rostrate.

Leaves ovate; corolla-tube glabrous inside	1. *P. pallida.*
Leaves cordate; corolla-tube hairy inside to the throat .	2. *P. odoratissima.*

1. **P. pallida**, W. et A.; Wight Ic. t. 585.—Syn. *Asclepias pallida*, Roxb. Fl. Ind. ii. 48. Vern. *Surkūla*, Kamaon.

A large twining shrub; young leaves and young shoots pubescent with soft, curved hairs. Leaves ovate from a cordate base, acuminate, 2-4 in. long, petiole about 1 in. Flowers pale yellow, inodorous, ½ in. long to tip of corolla-lobes, on pedicels as long as flowers or longer, in many-flowered, short pedunculate, umbelliform cymes; peduncles shorter than pedicels, both hairy. Calyx almost glabrous, the segments ciliate at the edges, nearly as long as the corolla-tube. Corolla-lobes linear, twice the length of tube; throat and inside of tube glabrous, except near its base. Follicles lanceolate, glabrous, 3 in. long.

Bengal, Behar, Burma, plains of N.W. India and the Panjab. Fl. June-Oct.

2. **P. odoratissima**, Linn.; Wight Ic. t. 414; Bot. Reg. t. 412.—The West Coast or Primrose-Creeper, *Kanja-lūta*, Beng.

A large twining shrub; bark deeply cracked and spongy, young shoots and inflorescence pubescent. Leaves deep-cordate, acuminate, about 4 in. long and nearly as broad, pubescent along the nerves on both sides, and with a few scattered hairs between the nerves, petiole 1 in. long. Inflorescence similar to that of *P. pallida.* Flowers ⅜ in. long, greenish yellow or orange, exceedingly fragrant. Calyx pubescent and ciliate, shorter than corolla-tube. Corolla-tube hairy inside to the throat, broad, nearly as long as the oblong lobes. Follicles ovate-lanceolate.

Cultivated generally in gardens in India and China. Indigenous in Bengal, Burma, and the N.W. Himalaya, where it ascends to 4000 ft. Has been found as far west as Jaunsar Bawar. Fl. May-July.

6. ORTHANTHERA, Wight.

A glabrous leafless shrub, with minute subulate scales in the place of the leaves. Flowers ¼ in. long, green, on short pedicels, in short pedunculate axillary umbelliform cymes of 3-6 flowers. Peduncles, pedicels, calyx, and corolla villous with long soft hairs. Calyx parted nearly to the base into 5 linear-lanceolate segments, as long as corolla-tube. Corolla campanulate, tube cylindric, longer than the oblong, erect segments, which are valvate in bud. No corona, but the staminal tube girt at the base by an undulate ring. Pollen-masses 10, stipitate, erect. Follicles compressed, linear, glabrous, erect, 4-5 in. long.

1. **O. viminea**, Wight; Jacq. Voy. Bot. t. 115.—Vern. *Mowa, lanebār*, Trans-Indus; *Matti*, Bias; *Khip*, Delhi; *Kip*, Sindh; *Chapkia*, Kamaon; *Māhūr*, Baraich, Gonda.

Grows 3-6 ft. high, with erect branches. Fl. March, April. Trans-Indus, Sindh, Panjab, the Doab, sub-Himalayan tract, ascending to 2000 ft., eastwards known as far as the Baraich and Gonda forests in Oudh, where it is abundant in the beds of streams, and where the flower-buds are eaten as a vegetable, cooked or raw (R. Th.) Rope is made of the fibre, after 4 or 5 days' steeping.

ORDER LVI. BORAGINEÆ.

Herbs, usually with rough hairy leaves, or trees and shrubs, glabrous or hairy. Leaves alternate, rarely opposite, usually undivided, without stipules. Inflorescence definite; flowers in 1-sided (scorpioid) spikes or racemes, rolled back when young, and often forked or dichotomous, or in more or less compound, often irregular cymes. Calyx free, persistent, lobes or teeth 5, rarely 4 or 6, valvate in bud. Corolla gamopetalous, hypogynous, segments as many as those of the calyx, imbricate or induplicate in the bud. Stamens inserted in the corolla-tube, as many as corolla-lobes, and alternate with them; anthers 2-celled, the cells usually opening in longitudinal slits. Ovary free, of 2 carpels, entire or 4- rarely 2-lobed, 2-celled, with 1 or 2 ovules in each cell, or 4-8-celled, with 1 ovule in each; style simple or 2-4-fid, terminal or inserted between the lobes. Fruit a drupe or dry, and separating into 4, rarely 2, 1-seeded nuts. Seed with a thin testa, albumen none or scanty, embryo straight, radicle short.—Royle Ill. 303, 306 (*Cordiaceæ*); Wight Ill. ii. 208.

Style twice forked; drupe with 1 kernel . . . . . 1. CORDIA.
Style bifid; drupe with 2-4 kernels . . . . . . 2. EHRETIA.
Style undivided; berry with 4 kernels . . . . . 3. RHABDIA.

This Order is here accepted in its wider sense, including *Cordiaceæ*, which is often regarded as a separate Order. It is divided into four great tribes: 1. *Cordieæ*, 2. *Ehretieæ*, with undivided ovary, terminal style, and indehiscent, often fleshy 4-seeded fruit. In *Cordieæ* the style is twice forked, in *Ehretieæ* 2-lobed (*Ehretia*), rarely undivided (*Rhabdia*). 3. *Heliotropieæ*, ovary often lobed, but style terminal, fruit dry, often separating into several 1-seeded cocci. To this group belongs the sweet-scented Heliotrope (*H. peruvianum*, Linn.), from the Andes of South America, which thrives so luxuriantly on the Nilgiris and in South Europe. 4. *Borageæ*, the ovary of 2, generally 4, distinct lobes, the style in the middle between them. To this group belong numerous annual or perennial herbaceous plants of Europe and Central Asia, of which the *Borage*, *Bugloss*, and the *Forget-me-not* are well-known examples.

1. CORDIA, Linn.

Trees or shrubs; flowers often polygamous, in terminal or leaf-opposed cymes, bracts small or none. Calyx tubular turbinate or campanulate, 4- or 5-toothed or irregularly toothed or lobed. Corolla-tube cylindrical or funnel-shaped, limb 4-5, sometimes more, -lobed. Ovary entire, 4-celled, 1 ovule in each cell; style terminal, twice forked. Fruit a drupe, endocarp hard, often perforated at the apex, cells 4 or fewer by abortion. Albumen none, cotyledons plaited lengthwise.

Leaves generally alternate, ovate or cordate; flowers generally pentandrous.	
Leaves broad-ovate or rotundate, base rounded or cuneate; calyx not ribbed	1. *C. Myxa.*
Leaves cordate; branchlets with dense grey or tawny tomentum; calyx ribbed	2. *C. Macleodii.*
Leaves broad-elliptic, or rotundate, dense tufts of rust-coloured hairs at the axils; calyx ribbed . . .	3. *C. vestita.*
Leaves generally subopposite, oblanceolate; flowers generally tetrandrous	4. *C. Rothii.*

1. **C. Myxa**, Linn.; Roxb. Fl. Ind. i. 590; Wight Ill. t. 169.—Syn. *C. obliqua*, Willd.; Wight Ic. t. 1378. *C. latifolia*, Roxb. l. c. 588. *C. polygama*, Roxb. l. c. 594. Sans. *Selu*. Vern. *Lasōra*, *lassōra*, *lesūra*, *bhokar*, Hindi; *Laswāra*, *lasiāra*, Pb.; *Lesūri*, *gidūri*, Sindh; *Borla*, *bairala*, *baurala*, Kamaon; *Gondhun*, *khātu*, Satpura range, C.P.; *Bargūnd*, *vargūnd*, Mar.; *Sepistan*, *pistan*, Guz.; *Thanatben*, Burm.

A middle-sized tree; young leaves soft-pubescent beneath, more or less rough when full-grown, broad-ovate or rotundate, base rounded or short-cuneate, blade 3-6 in. long, petiole 1-2 in.; main lateral nerves 4-6 pair, 1 or 2 pair from the base of the leaf. Flowers white, polygamous, pentandrous, on short pedicels, in loose terminal and lateral pedunculate cymes, without bracts. Calyx without prominent ribs, entire and closed over the corolla in the bud, splitting irregularly, when the flower expands, into 5 short lobes, nearly glabrous outside, lobes hairy inside. Corolla-tube nearly as long as calyx, with 5 narrow, recurved lobes, as long as the tube. Stamens exserted, filaments hairy. Drupe supported by the enlarged and hardened calyx, its limb irregularly and broadly toothed, ovoid or nearly globose, ¾-1¼ in. long, puberulous when young; when ripe, minutely rugose, but shining, yellowish brown, pink or nearly black. Kernel very hard, rugose, 1- or 2-celled, in a rough viscid sweetish almost transparent pulp.

Cultivated throughout India, wild in the Panjab Salt range, the outer Himalaya and Siwalik tract, from the Chenab to Assam, ascending to 5000 ft. Kasia hills. Gonda forests in Oudh, Satpura range, C.P. Also South India, Ceylon, Burma, Indian Archipelago, and Queensland. Leaves are shed in April, and renewed soon after; fl. March, April; fr. May-July. Growth moderately quick, 3-6 rings per in. A very hardy tree. 30-40 ft. high, trunk short, erect or somewhat crooked, 4-5, at times 6 ft. girth, branches numerous, spreading, then ascending, forming a handsome rounded crown with dense bright-green foliage. Branchlets reddish grey, glabrous, bark ½-1 in. thick, light- or dark-cinereous, brown, sometimes blackish, rough with shallow longitudinal wrinkles and furrows, inner substance fibrous. Wood olive-coloured, greyish, or light brown. No distinct heartwood. The horizontal section shows numerous broad medullary rays and large pores, as well as concentric bands of whitish tissue, alternating with narrow bands of darker tissue. Pores and medullary rays prominent on a vertical section. Soft and somewhat porous, but fairly strong, weight 33-49 lb. per cub. ft. Seasons well, but does not stand exposure, and is apt to be attacked by insects. Employed in boat-building, for gun-stocks, well-curbs, and agricultural implements. Excellent fuel. The bark is made into ropes and fuses; the fibre is also used in caulking boats. The leaves are used as plates, and in Pegu for the covering leaf of the Burma cheroots. The tender young fruit is eaten as a vegetable, and is pickled; the ripe fruit is eaten, and is greedily devoured by birds. The adhesive viscid pulp is used as bird-lime. Its juice is employed instead of that of the marking-nut (*Semecarpus Anacardium*), but the colour is transient. The kernel is eaten, tastes somewhat like a filbert; that of the cultivated tree is better.

C. Wallichii, G. Don; Bedd. Fl. Sylv. t. 245; is allied to this species, but the leaves are more cordate, and clothed beneath with dense grey tomentum. Forests of the western coast and Mysore.

2. **C. Macleodii**, H. f. & Th.—**Tab. XLI.**—Linn. Soc. Journ. ii. 128. —Syn. *Hemigymnia Macleodii*, Griff. Vern. *Deughan*, *dhāian*, *dahi*, *deingan*, *dhāman*, *dewan*, C.P.; *Dhaivan*, Sattara.

A middle-sized tree; branchlets, under side of leaves, inflorescence, and calyx clothed with dense grey or tawny tomentum. Leaves alternate or subopposite, cordate, pubescent above, membranous when young, afterwards firm and hard, upper surface rough, uneven, but somewhat shining; blade 5-7 in. long and nearly as broad, petiole 2-3 in.; three prominent basal nerves, each of the 2 outer with 4-5 main lateral nerves on the outside, the middle nerve with 4-5 main lateral nerves on either side, all joined by prominent parallel transverse veins. Flowers polygamous, white, on subsessile, compound, axillary and terminal cymes. Bracts none. Calyx at the time of flowering cylindrical, wider above, almost clavate, $\frac{1}{3}$ in. long, ribbed and furrowed, splitting into 3-5, usually 5 unequal teeth. Corolla-tube shorter than calyx, lobes obovate-oblong, as long as tube, undulate, spreading or reflexed. Stamens exserted, filaments hairy at the base. Male flowers with a rudimentary ovary, without style or stigma. Drupe $\frac{1}{2}$ in. long, ovoid, cuspidate with the persistent base of style, and girt by the enlarged and hardened cup-shaped calyx, with a ribbed, crenate and denticulate edge.

Central India, from the Mahanadi river in Bijoragogarh (D.B.), (probably also in Behar), to the Nagpahar near Ajmir (D.B.), West Dekkan as far south as Belgaum (Dr Ritchie, D.B.), and probably (specimens imperfect) on dry hills near Chikmaglur in Mysore, D.B. First brought to notice by the late Sir D. F. Macleod, who sent specimens from Jubbulpur (in 1842) to Dr Griffith. Attains 30-40 ft., with short trunk, 3-4 ft. girth, and strong spreading boughs, forming a close, rounded crown. Bark thick, soft, corky, grey. Fl. April, May; fruit C.S. Heartwood light brown, beautifully mottled with darker veins and whitish lines. Weight 40-50 lb. per cub. ft. Even-grained, hard, strong, tough and elastic, seasons well and works easily. Used for furniture, picture-frames, and other ornamental work. Excellent fishing-rods are made of it.

3. **C. vestita,** H. f. & Th.; Linn. Soc. Journ. ii. 128.—Syn. *C. incana,* Royle; *Gynaion vestitum,* A. DC. Vern. *Kūmbi, karūk,* Pb.; *Kūm pāiman, pīn, īndak,* N.W.P.; *Chinta, ajānta,* Oudh.

A small or middle-sized tree; branchlets, under side of leaves and inflorescence clothed with soft grey pubescence; leaf-buds and base of petioles enveloped in dense tufts of long tawny or rust-coloured hairs. Leaves alternate, broad-elliptic or rotundate, upper side very rough, blade 3-4 in. long, 2-3 in. broad, petiole 1-1½ in. long; main lateral nerves 3-5 pair, the lowest pair proceeding from the base. Flowers yellowish-white, polygamous, in compound cymes, often several together on short peduncles at the ends of branches; cymes of male flowers often composed of unilateral racemes. Calyx at the time of flowering clavate, ⅓-½ in. long, ribbed and furrowed, splitting into a number of unequal teeth. Corolla-tube as long as calyx, lobes obovate-oblong, as long as tube, undulate, spreading. Stamens exserted, filaments hairy at the base. A rudimentary ovary without style or stigma in the male flowers. Drupe ¾ in. long cuspidate with the persistent base of style, and girt at base with the enlarged, hardened, flat cup-shaped calyx, ¾-1 in. across, with a ribbed, crenate and denticulate edge.

Sub-Himalayan tract and outer ranges from near the Jhelam to the Sarda river, ascending to 4000 ft. Hill forests of Baraich and Gonda in Oudh. Nowhere common, rare west of the Jumna. The flowers appear with or shortly before the young leaves in March, April; the fruit ripens Oct., Nov. Often only 15-20 ft. high, and 3-4 ft. girth. A planted tree on Mount Tilla in the Panjab Salt range 8 ft. girth, and 25-30 ft. high. Branchlets marked by the scars of the fallen petioles. Bark ½ in. thick, dark grey or blackish, rugose and longitudinally furrowed, when old exfoliating in large woody scales, showing the smooth silvery grey inner bark. The dark-green foliage is clustered near the ends of branches. Sapwood whitish, heartwood distinct, of a chocolate-brown colour, with conspicuous medullary rays. Close-grained, hard, heavy and strong. Employed for wheel- and well-work. The fruit is filled with a gelatinous pulp, which is eaten, and is preferred to that of *C. Myxa.*

4. **C. Rothii,** Roem. & Schultes; Wight Ic. t. 1379.—Syn. *C. angustifolia,* Roxb. Fl. Ind. i. 595. Vern. *Gondi, gondni, gundi.* Local: *Liār, liāi,* Sindh.

A small or moderate-sized tree. Leaves rough and pubescent beneath while young, generally subopposite, oblanceolate or cuneate-oblong, blade 3-4 in. long, and 1-1½ in. broad, petiole ½ in. long. Flowers small, white, generally tetrandrous, in loose, terminal or axillary pedunculate cymes; peduncles and pedicels slender, glabrous or slightly pubescent, bracts none. Calyx at the time of flowering turbinate. Corolla-tube somewhat shorter than calyx, lobes 4 or 5 oblong, reflexed. Stamens 4 or 5 exserted. Drupe ovoid, acute, mucronate, ½ in. long, yellow or reddish brown when ripe, glabrous, longitudinally striate, fleshy, with yellow, gelatinous pellucid pulp; generally 1-seeded.

Planted and self-sown near villages in the Panjab south of the Salt range, Sindh, N.W.P., Rajputana, Guzerat, and Dekkan. Wild in the Kishengurh forests north-east of Ajmir (D.B.); in Mysore, and probably in other parts of the peninsula. Also in Arabia and Abyssinia. Leaves are renewed in Feb., March. Fl. April-June; fruit ripens in the ensuing cold season. Coppices well. Attains 30-40 ft., trunk short, 3-5 ft. girth, branches spreading, extremities often drooping, forming a somewhat lax, rounded crown. Twigs cinereous, bark of stem thick, light or dark grey, or brownish, longitudinally furrowed, not much cracked. Heartwood light yellow or light brown, tough, 42-52 lb. per cub. ft. Used as fuel, in Sindh for building, and in Cutch for agricultural implements. A gum issues from wounds in the bark. Ropes are made of the bark. The pulp of the drupe is adhesive, hence its name (*gond*, gum), and is eaten, though insipid.

2. **EHRETIA,** Linn.

Trees or shrubs, often glabrous; leaves alternate. Flowers in terminal or axillary cymes, with small bracts. Calyx deeply divided into 5 segments, persistent, but not enlarged in fruit. Corolla-tube short or cylindrical, limb of 5 spreading lobes, imbricate in bud. Stamens generally exserted. Ovary 2-celled with 2 ovules in each cell, or 4-celled, 1 ovule in each cell; style terminal bifid. Fruit a drupe, the endocarp forming two 2-seeded, or four 1-seeded pyrenes. Albumen scanty, cotyledons ovate, not plaited.

Leaves serrate; flowers in terminal panicles, pyrenes 2 . .	1. *E. serrata.*
Leaves entire; flowers in terminal and axillary compound corymbose cymes; pyrenes 4.	
Leaves elliptic; flowers sessile; corolla not much longer than calyx	2. *E. lævis.*
Leaves spathulate; flowers pedicellate; corolla twice the length of calyx	3. *E. obtusifolia.*

1. **E. serrata,** Roxb. Fl. Ind. i. 596; Bot. Reg. t. 1097.—Vern. *Pūna*, N.W. India; *Puran*, *kalthāun*, Pb.; *Pūnyan*, *pūnjlawāi*, *panden*, *koda*, N.W.P.; *Kurkūria*, *arjūn*, Oudh; *Nalshūna*, Nepal.

A middle-sized tree; glabrous, only leaves and branches of inflorescence with scattered, short, generally adpressed hairs. Leaves elliptic-oblong, acuminate, sharp-serrate, blade 4-6 in., petiole ¾ in. long; main lateral nerves arching, 8-10 on either side of midrib. Flowers numerous, white, small, fragrant, sessile, in clusters of 3-5, in large terminal pyramidal panicles. Corolla rotate. Drupe with two 1- or 2-seeded pyrenes, red orange or nearly black when ripe, as large as a small pea.

Sub-Himalayan tract and outer ranges from near the Indus to Sikkim, ascending to 4000, occasionally to 5500 ft. Cultivated in India, China, the Mauritius, and elsewhere. (*E. acuminata*, R. Br., Benth. Fl. Austr. iv. 387, of Queensland and N.S. Wales, is nearly allied to this species.) Fl. Feb.-April, occasionally July-Dec.; fr. Nov.-Dec., remains long on the tree. Attains 40 ft., with a short straight trunk 4-5 ft. girth, numerous branches, forming a handsome, shady oval crown, resembling *Cordia Myxa* in appearance. Bark dark grey or brown, even, with longitudinal furrows; when old, with many small ragged, mostly longitudinal cracks, inner substance brown, leathery, fibrous. Wood light brown, with white specks, fairly even and compact, soft, not heavy, easily worked, made into scabbards, sword-hilts, gun-stocks, and employed in building and for agricultural implements. Weight 37 lb.; value of P. 530 (Kyd). Not durable. The unripe fruit is pickled; ripe it is insipidly sweet, and is eaten.

2. **E. lævis**, Roxb.—**Tab. XLII.**—Cor. Pl. t. 56; Fl. Ind. i. 597; Wight Ic. t. 1382.—Vern. *Chamrōr, chamrūr, chamraud,* N.W. India; *Chambal, gīn,* Pb.; *Kōda, darar,* N.W.P.; *Datranga,* Oudh; *Tambōli,* Banda; *Tambolia,* Banswara; *Dotti mara,* Gonds, C.P.

A middle-sized tree; glabrous or more or less pubescent and ciliate. Leaves membranous when young, firm and nearly coriaceous when full-grown, entire, elliptic, obtuse or acuminate, blade 3-8 in., petiole ½ in. long; main lateral nerves 6-10 on either side of midrib, arcuate, joined by more or less prominent intramarginal veins. Flowers small, white, sessile or subsessile, in loose, terminal and lateral cymes, composed of unilateral spikes; bracts none. Calyx hairy, lobes ovate, obtuse. Corolla rotate or broad-campanulate, tube a little longer than calyx, lobes twice the length of tube. Anthers not apiculate. Drupe nearly 2-lobed, somewhat broader than long, ⅙ in. across, red, afterwards black, wrinkled, a scanty pulp enclosing 3-4 triquetrous, 1-seeded pyrenes.

Trans-Indus, on eastern skirts of Suliman range, ascending to 2500 ft., Panjab, Siwalik tract, ascending to 2000 ft., occasionally in the Panjab plains. Gangetic plain, and sub-Himalayan tract, ascending to 2500 ft. Oudh forests, Central India, Behar, Guzerat, and the Konkan. The old leaves are shed Jan., Feb.; the new foliage issues Feb., March, and is light-green, somewhat viscid. Fl. Jan., Feb., before the leaves are quite out, occasionally up to May, or later; fruit April-June. Hard vesiculose galls not rare on inflorescence. Attains 30, at times 40 ft., trunk erect, short, irregularly scooped, 3-4, at times 5-6 ft. girth. Many large branches, ascending and spreading into a rounded, lax crown. Branchlets light grey, or with a reddish tinge, smooth. Bark ½-1 in. thick, light-yellowish grey with dark specks. Foliage dark green. Wood dirty-white or yellowish brown, compact, even- and fine-grained, tough, easily worked, used for agricultural implements, and for building. The inner bark, in times of famine, is mixed with flour and eaten. The leaves are given as cattle-fodder. The fruit is tasteless, but is eaten.

E. floribunda, Royle; Benth. in Royle Ill. p. 306, from the Dehra Doon, also found by Stocks at Shah Bilawal in Sindh, seems to me to be merely a variety with acuminate, soft-pubescent and ciliate leaves.

E. aspera, Roxb. Cor. Pl. t. 55; Fl. Ind. i. 598, with smaller elliptic or oblong-elliptic leaves, tomentose beneath, scabrous and pubescent above, terminal corymbose cymes and small globose drupes has not been found within the range of this Flora. It is closely allied to *E. ovālifolia,* Wight Ic. t. 1383, of South India and Ceylon.

3. **E. obtusifolia,** Hochstetter; DC. Prodr. ix. 507.

A small shrub, with grey branches. Leaves rough and hairy, spathulate or obovate, entire, 1-2 in. long. Flowers ¼ in. long, in short, lax, hairy cymes at the top of small branchlets, pedicels as long as calyx, or longer. Calyx-lobes lanceolate. Corolla campanulate, twice the length of calyx, lobes ovate, as long as tube. Drupe ¼ in. across, with four 1-seeded pyrenes.

Sindh. Salt range, Panjab. Abyssinia. Fl. March, April.

3. RHABDIA, Martius.

Shrubs with alternate leaves. Calyx deeply divided into 5 segments, persistent. Corolla-tube short, limb 5-lobed. Ovary 2-celled, style undivided. Fruit a dry berry with 4 pyrenes; seeds albuminous, radicle superior.

1. **R. viminea,** Dalzell in Hooker Ic. Plant. ix. t. 823.—Syn. *Ehretia viminea,* Wall. ; *E. cuneata,* Wight Ic. t. 1385.

A small much-branched shrub, branches twiggy. Leaves spathulate, entire, narrowed into a short petiole, about 1 in. long, more or less hairy with stiff adpressed white hairs, at times densely hispid or nearly glabrous. Flowers pink, on short pedicels, 2 or 3 at the ends of short lateral branchlets. Calyx hispid, longer than corolla-tube, somewhat enlarged in fruit, which is the size of a small pea, and orange-red when ripe.

Rocky, sandy and shingly beds of streams, Kamaon, ascending to 2500 ft., East Bengal, Banda, Konkan, Mysore, Burma. Fl. Oct., Nov.; branches frequently creeping and rooting.

ORDER LVII. CONVOLVULACEÆ.

Herbs, rarely shrubs, often twining. Leaves alternate, without stipules. Flowers regular, pentamerous, bisexual, usually large and showy. Calyx free, persistent, often enlarged in fruit, of 5 distinct sepals, much imbricate in bud. Corolla generally campanulate or funnel-shaped, the limb usually spreading, 5-angled or 5-lobed, folded in the bud, rarely imbricate. Stamens 5, often of unequal length, inserted in the corolla-tube or at its base, and alternating with the lobes or angles of the limb; anthers with 2 parallel cells dehiscing longitudinally. Ovary free, 2- 3- or 4-celled, 1 or 2 ovules in each cell, or 1-celled with 2 or 4 ovules. Fruit a capsule or succulent and indehiscent. Seeds with scanty mucilaginous albumen. —Royle Ill. 307; Wight Ill. ii. 200.

Style filiform; limb of corolla 5-angled or 5-lobed.
  Flowers small, ovary 1-celled; sepals much enlarged in fruit, forming long, veined membranous wings; fruit a 1-seeded capsule . . . . 1. PORANA.
  Flowers large, ovary 2- or 4-celled; sepals enlarged, but not membranous in fruit; fruit a dry or succulent berry . 2. ARGYREIA.
Stigma sessile; limb of corolla of 5 deeply 2-lobed divisions; fruit a berry, supported by the slightly increased calyx; leaves coriaceous, evergreen . . . . 3. ERYCIBE.

1. PORANA, Linn.

Large twiners. Leaves entire. Flowers usually small, paniculate in the Indian species. Sepals enlarged after flowering into long membranous wings, horizontally spreading under the fruit. Ovary 1-celled, with 2 or 4 ovules. Capsule usually 1-seeded by abortion.

1. P. **paniculata**, Roxb. Cor. Pl. t. 235; Fl. Ind. i. 464.

A large twining shrub; branches, panicles and under side of leaves with grey or brownish pubescence. Leaves cordate, acuminate, 2-4 in. long, petiole less than ⅓ the length of leaf, basal nerves 5-7. Flowers numerous, small, white, on pedicels longer than calyx, in large axillary and terminal drooping panicles; bracts shortly tomentose. Corolla ¼ in. long or less. Calyx half the length of corolla, sepals 3-5, enlarged after flowering, into ovate-oblong, membranous, shortly petiolate, reticulate wings, ¾-1 in. long, surrounding the globose brittle villous capsule, which is about the size of a small pea.

Bengal, sub-Himalayan tract to the Ganges, ascending to 4500 ft., Burma. Fl. Nov.-Feb.; fr. March, April.

2. **ARGYREIA**, Loureiro.

Large, often woody climbers. Leaves entire, rarely lobed, clothed beneath with silky, often silvery white hairs. Flowers large, in axillary cymes, rarely solitary; corolla funnel-shaped or campanulate. Ovary 2-celled, with 2 ovules in each cell, or 4-celled by a spurious dissepiment between the ovules; style filiform, stigma capitate, entire or 2-lobed. Fruit indehiscent, a dry or succulent berry, 2-4-seeded; cotyledons folded.—This genus was divided into 2 by Choisy in DC. Prodr. ix. 325, *Rivea* with a 4-celled and *Argyreia* with a 2-celled ovary. I follow Bentham, Fl. Hongkong. 236, in uniting them.

- Leaves cordate or broad-ovate, breadth equal to the length or nearly so.
  - Flowers white, corolla funnel-shaped; leaves with 5-7 prominent basal nerves, midrib penniveined.
    - Peduncles 1-2-flowered . . . . 1. *A. uniflora*.
    - Flowers in corymbose or panicled pedunculate cymes . . 2. *A. ornata*.
  - Flowers rose-coloured or purple, corolla campanulate; leaves penniveined.
    - Branches and under side of leaves white-tomentose . . . . 3. *A. speciosa*.
    - Branches and under side of leaves hairy.
      - Flowers sessile in compact pedunculate heads with long, lanceolate bracts . . . . 4. *A. capitata*.
      - Flowers pedicellate in corymbose cymes with short bracts . 5. *A. setosa*.
- Leaves cuneate-oblong, much longer than broad . . . . 6. *A. cuneata*.

The geographical distribution in India of several of the species here described is imperfectly known. I have selected those most likely to be met with in the forests of North and Central India.

1. **A. uniflora**, Sweet.—Syn. *Rivea hypocrateriformis*, Choisy in DC. Prodr. ix. 326. *Lettsomia uniflora*, Roxb. Fl. Ind. i. 495.

A woody climber; branchlets and under side of leaves hoary or white silky-tomentose. Leaves broad-cordate, obtuse, emarginate or apiculate, 3-6 in. broad, basal nerves 5-7, petiole about as long as leaf. Flowers large, pure white, peduncles 1-3-flowered, pedicels (shorter than peduncles) in the axils of linear, deciduous bracts. Corolla-tube 2-3 in. long, slender, cylindrical, limb 1-2 in. diam.

Sindh, common on dry hills. Panjab, Central India, South India. Fl. May-Aug. The flowers open at sunset, and close at sunrise.

A. bona-nox, Sweet.—Syn. *Lettsomia bona-nox*, Roxb. Fl. Ind. i. 494. *The Midnapur creeper.* A gigantic climber with spongy cracked ash-coloured bark, has larger flowers; very fragrant. Roxburgh calls it the prince of Convolvulaceæ. Bengal (Serampur, Midnapur), Guzerat, the Konkan. Fl. R.S.

2. **A. ornata**, Sweet.—Syn. *Rivea ornata*, Choisy; DC. Prodr. ix. 326; Wight Ic. t. 1356. *Lettsomia ornata*, Roxb. Fl. Ind. i. 496.

Differs from *A. uniflora* mainly by having the flowers in large spreading corymbose or panicled pedunculate cymes, peduncle generally longer than petiole. This, as well as the preceding species, demand critical study on the spot.

Oudh forests, Nepal, Panjab (Aitchison), and probably widely spread in North-West India. Ceylon. Fl. R.S.

3. **A. speciosa**, Sweet; DC. Prodr. 328.—Syn. *Ipomœa speciosa*, Bot. Mag. t. 2446. *Lettsomia nervosa*, Roxb. Fl. Ind. i. 488. *The Elephant Creeper.*

A large woody climber running up the highest trees. Branches and under side of leaves white with a dense tomentum of soft silky hairs. Leaves cordate, acuminate, penniveined, 4-12 in. long, and nearly as broad, petiole shorter than leaf or nearly as long; main lateral nerves numerous, prominent, parallel. Flowers deep rose-coloured in axillary corymbose cymes, peduncles longer than petiole, and sometimes longer than leaf, pedicels as long as calyx; bracts large, foliaceous, ovate, acuminate, deciduous. Corolla campanulate, tube 1½ in. long, limb 2 in. diam.

South India, Bengal, North-West India (Dehra Doon, Voigt. Hort. Suburb. 351). Fl. R.S.

4. **A. capitata**, Choisy; DC. Prodr. ix. 332.—Syn. *Lettsomia strigosa*, Roxb. Fl. Ind. i. 491.

A large woody climber; branchlets, inflorescence and leaves strigose with long harsh brown hairs. Leaves ovate from a cordate base, acuminate, penniveined, blade 3-5 in. long. Flowers rose-coloured or lilac, sessile in pedunculate bracteate heads, supported by numerous ovate bracts, with long rust-coloured hairs, peduncles longer than petioles. Corolla campanulate.

Eastern Bengal, Burma. Fl. Oct., Nov. *A. barbigera*, Choisy—syn. *Convolvulus barbiger*, Wall., is closely allied, if specifically distinct. Burma. Java. Eastern Bengal. N.W. Himalaya.

5. **A. setosa**, Choisy l. c. 332.—Syn. *Lettsomia setosa*, Roxb. Fl. Ind. i. 490 ; Wight Ic. t. 1360.

A large woody climber ; young shoots and under side of leaves strigose with adpressed hairs. Leaves broad-ovate from a cordate base, penniveined, blade 3-5 in. long. Flowers pink, shortly pedicellate, in compound corymbose pedunculate cymes. Bracts broad-ovate, deciduous. Corolla campanulate.

Northern Circars, Dekkan. Fl. Nov.-Jan. This sp. is closely allied to *A. capitata*. They require farther examination on the spot.

6. **A. cuneata**, Bot. Reg. t. 661 ; DC. Prodr. ix. 330.—Syn. *Lettsomia cuneata*, Roxb. Fl. Ind. i. 491.

A large woody climber with smooth dark grey bark, young shoots and leaves with adpressed silky hairs. Leaves deep green, cuneate-oblong 3-4 in. long, petiole ½ in. long or less. Flowers large, bright deep purple, on slender pedicels, in short axillary 3-flowered pedunculate cymes ; bracts linear. Corolla campanulate.

Nilgiris, Pulneys, Western Ghats as far north as Bombay, cultivated in gardens. Fl. Aug.-Sept.

3. ERYCIBE, Roxb.

Large climbing shrubs with entire, evergreen, coriaceous leaves. Corolla-tube short, lobes bifid, middle part firm coriaceous, hairy outside, segments folded in bud. Stamens at the base of the corolla-tube, filaments short. Ovary 1-celled, with 4 erect ovules ; stigma thick sessile, lobed. Fruit an indehiscent 1-seeded berry ; cotyledons folded.

1. **E. paniculata**, Roxb. Cor. Pl. t. 159 ; Fl. Ind. i. 585 ; Wight Ill. t. 180.

A large climbing shrub ; young shoots and inflorescence covered with rust-coloured pubescence. Leaves elliptic-oblong, abruptly acuminate (caudate), 3-5 in. long, narrowed into a short petiole ; main lateral nerves arcuate, 4-6 on either side of midrib. Flowers yellow, in long terminal leafy panicles. Calyx and middle part of corolla-lobes with dense rust-coloured hairs, appendices (segments of corolla-lobes) rounded, glabrous, membranous. Connective prolonged beyond anthers, apiculate. Berry subglobose, ½ in. diam., supported by the persistent calyx, pulpy, black when ripe.

South India, Ceylon, Burma, Bengal, Oudh forests. Fl. June-Nov. Indian Archipelago, Queensland.

E. Wightiana, Graham Cat. Bombay Plants, 137 ; scandent, with rigid stems, and white, fragrant flowers, may possibly only be a variety of *E. paniculata*.—Western Ghats, Bombay to Belgaum.

ORDER LVIII. SOLANEÆ.

Herbs, shrubs or soft-wooded trees. Leaves alternate, without stipules. Flowers regular, bisexual, usually pentamerous. Calyx free, usually gamosepalous. Corolla gamopetalous, lobes 5, rarely 4, induplicate-plicate, rarely imbricate in bud. Stamens epipetalous, as many as corolla-lobes, alternating with them. Ovary free, generally 2-celled, multiovulate; style simple, terminal, with an entire or lobed stigma. Fruit an indehiscent berry, rarely a capsule, with several seeds. Embryo usually curved or spiral, albumen fleshy.—Royle Ill. 279; Wight Ill. ii. 194.

1. LYCIUM, Linn.

Shrubs, branchlets often spinescent. Leaves entire, usually small, often clustered. Calyx with 5, rarely 4 teeth, often splitting into 3-5 lobes. Corolla funnel-shaped, limb 5- rarely 4-lobed, the lobes imbricate in bud. Stamens usually unequal; anthers 2-celled, dehiscing longitudinally. Ovary 2-celled. Fruit an ovoid or globose berry.

Leaves lanceolate or oblanceolate; corolla-tube subcylindrical, more than twice the length of the lobes; calyx 5-dentate . 1. *L. europæum.*
Leaves linear; corolla funnel-shaped, tube somewhat longer than segments, but not twice their length; calyx with 3-4 unequal lobes . . . . 2. *L. ruthenicum.*

1. **L. europæum**, Linn.; Sibthorp Fl. Græc. t. 236.—Syn. *L. indicum*, Wight Ic. t. 1403; *L. mediterraneum*, Dunal; Prodr. xiii. i. 523. Vern. *Ganger, kangu, kango, kūngu, kūnga būti*, Pb.; *Chirchitta, niral*, Delhi and Harriana.

A thorny shrub, with lanceolate or oblanceolate leaves, sometimes pubescent when young, ½-1 in. long, alternate or fasciculate; branches grey. Flowers white, ½ in. long, solitary, on slender pedicels shorter than flower. Calyx campanulate, longer than broad, with 5 equal teeth. Corolla-tube cylindrical, gradually widening upwards, somewhat curved; segments of limb short, rounded or ovate. Filaments glabrous, anthers nearly included in the mouth of the tube. Berry globose, yellow, or red, ⅙ in. diam. The specimens of South Europe and Western Asia have larger leaves, light purple (or white) flowers, and a broader calyx.

Common in the plains of the Panjab, Sindh, and Guzerat.—Western Asia and South Europe. Fl. Oct.-March. The fruit is eaten, camels and goats feed on the branches. It is used as fuel, and jhamps (wattled frames) for the walls of huts are made of it. Hardy in England.

L. barbarum, Linn.; Miers Illustr. of South American Plants, t. 69, with pedicels as long as flowers, corolla-segments nearly as long as tube, stamens exserted, and berry ovoid, grows in Western Asia, Afghanistan, and Beluchistan (naturalised in Europe), and will probably be found in Sindh and the Panjab. *L. Edgeworthii*, Dunal; Prodr. xiii. 525, from Sirhind, seems to belong to this sp.

2. **L. ruthenicum**, Murray; Prodr. xiii. i. 514; Miers l. t. 70.—Vern. *Khichar*, *khītsar*, *kītserma*, Ladak.

A small thorny shrub, wholly glabrous. Branchlets nearly white, spines at right angles. Leaves fleshy, linear, 1-2 in. long. Flowers solitary, ½ in. long, on pedicels half the length of flower. Calyx white, transparent, with 3-4 unequal lobes. Corolla funnel-shaped, segments longer than half the length of tube. Anthers long exserted. Berry globose, ¼ in. diam.

Siberia, Caucasia, Western Tibet. Common in the Nubra valley and Ladak at 10,000-13,500 ft. Fl. Aug.-Sept. Fruit sweet, but without flavour, eaten. Hardy in England.

ORDER LIX. BIGNONIACEÆ.

Trees, shrubs or woody climbers. Leaves opposite, rarely alternate, compound, rarely simple, without stipules. Flowers bisexual, often irregular. Calyx free, tubular or campanulate, truncate toothed or split, lobes valvate in bud. Corolla tubular or campanulate, often bilabiate, lobes 5 spreading, generally unequal, imbricate, rarely valvate in bud. Stamens 2 or 4, rarely 5, in pairs, in the place of the fifth stamen generally a short staminodium; anthers 2-celled, rarely 1-celled, the cells opening longitudinally. Ovary free, supported by an annular disc, 2-celled, placentas two distinct in each cell attached to the dissepiment; ovules numerous; style filiform, with 2 short stigmatic lobes. Fruit often elongated, dehiscent, or indehiscent (*Crescentieæ*). Seeds numerous, usually flat and bordered by a membranous wing, albumen none. The following genera have all a dehiscent capsule, the 2 valves separating from the dissepiment, along the edges of which the seeds are attached.—Royle Ill. 294; Wight Ill. ii. 182; E. Bureau, Monographie des Bignoniacées (première partie), Paris, 1864.

Capsule flat, dehiscing septicidally, the dissepiment parallel to the valves, wings surrounding the seed on three sides; leaves bipinnate, opposite.
  Corolla campanulate; stamens 5, inserted above the base; anthers 2-celled . . . . 1. CALOSANTHES.
  Corolla funnel-shaped; stamens 4, inserted at the mouth of the long cylindric tube; anthers 1-celled . . . 2. MILLINGTONIA.
Capsule flat convex or cylindrical, dehiscing loculicidally, the dissepiment transverse to the valves, and attached to their median line before dehiscence.
  Seeds with long, bilateral wings; leaves pinnate or bipinnate.
    Dissepiment continuous, cylindrical flat or (on a horizontal section) cross-shaped; seeds flat . . . . . 3. SPATHODEA.
    Dissepiment jointed, cylindrical; nucleus of seeds wedge-shaped, embryo doubled up . . . . 4. STEREOSPERMUM.
  Seeds winged on three sides; leaves simple (digitate in extra Indian species) . . . . 5. TECOMA.

1. CALOSANTHES, Blume.

A soft-wooded tree, with large, opposite, bipinnate leaves. Calyx large, coriaceous, persistent, indistinctly toothed. Corolla campanulate, limb oblique, of 5, nearly equal, toothed or incised lobes. Stamens 5, inserted above the base of the corolla-tube, all fertile, and nearly equal; anthers 2-celled, cells parallel. Ovary on a thick fleshy cylindrical, somewhat pentagonal disc; 4 rows of ovules on each placenta. Capsule large, flat, linear, dehiscing at the edges, the dissepiment parallel to the valves. Seeds imbricate, surrounded on 3 sides by a broad transparent wing.

1. **C. indica**, Blume; Wight Ic. t. 1337/8; Bureau l. c. t. 9.—Syn. *Bignonia indica*, Linn.; Roxb. Fl. Ind. iii. 110. Sans. *Syonaka, parna.* Vern. *Mulin, sori, tātpalang, tātmorang*, Pb.; *Ullu, ulla, arlu, kharkath*, N.W.P.; *Pharkath*, Kamaon; *Sauna, assar sauna*, Oudh; *Tattunūa*, C.P.

Glabrous. Leaves 4-6 ft. long, pinnæ 3 pair, the lowest pair bipinnate, pinnules broad-ovate, acuminate, petiolulate, 4-8 in. long. Flowers large, fleshy, dark red, with an unpleasant smell, in erect terminal, somewhat unilateral racemes, on long rough hollow peduncles. Pedicels 1 in.; corolla 2-3 in. long, and nearly as broad at the mouth. Capsule shortly stipitate, 15-30 in. long and 2-3½ in. broad. Wings of seeds 2-2½ in. across.

Bengal, Burma, South and Central India. Sub-Himalayan tract, common as far as the Jumna, ascending to 3500 ft., rare between Jumna and Chenab. Ceylon and Java. The leaves are shed Feb., March, and renewed April, May. Fl. May-July. The great sword-like fruit ripens Dec.-Feb., and often remains hanging on the tree for months.

Often several stems together, 15-20 ft. high, 12 in. girth, bark ¼ in. thick, whitish brown, corky, wood white, open-grained, light and soft, no heartwood, pith large, chambered. The bark and fruit are used in tanning and dyeing, the seeds are used to line hats, and, placed between two layers of wickerwork, to make umbrellas. Root, bark, leaves, and seeds are used in native medicine.

2. MILLINGTONIA, Linn. fil.

A large tree, with opposite bipinnate leaves. Calyx with 5 short, truncate, recurved teeth. Corolla-tube long, slender, cylindrical, widened into a funnel-shaped, oblique mouth, at the base of which the stamens are inserted, and which is cleft half-way into 5, nearly equal, ovate-oblong slightly imbricate lobes, nearly valvate in bud. Stamens 4, didynamous, exserted, with a 5th staminode; anthers 1-celled, a short appendix in the place of the second cell. Ovules in 4 rows on each placenta. Capsule flat, linear, dehiscing at the edges, the dissepiment parallel to the valves; seeds imbricate, surrounded on 3 sides by a fine transparent wing.

1. **M. hortensis**, Linn. f.; Bedd. Fl. Sylv. t. 249; Bureau l. c. t. 8. —Syn. *Bignonia suberosa*, Roxb. Cor. Pl. t. 214; Fl. Ind. iii. 111.

Young leaves and inflorescence slightly pubescent. Leaves 12-24 in. long, pinnæ 3 pair, the lowest pair bipinnate at base, pinnules ovate, acuminate, petiolulate, the blade 1-2 in. long. Flowers numerous, fragrant, pure white, in large terminal panicles; bracts minute, ciliate. Corolla 3-4 in. long. Capsule 12 in. long.

Cultivated in avenues and gardens in most parts of India, believed to be indigenous in Burma and the Indian Archipelago. In North India the cultivated tree seeds very rarely. Attains 50-60 ft., bark corky, deeply cracked. Fl. C.S. Wood whitish, firm and close-grained. Weight 42 lb.; value of P. 610.

3. **SPATHODEA**, Beauv.

Trees with opposite (rarely alternate) imparipinnate or bipinnate leaves. Flowers in racemes or in terminal trichotomous, cymose panicles. Calyx truncate lobed or spathaceous. Corolla funnel-shaped, limb oblique, the lower cylindrical part of the tube varying in length, the stamens inserted at its upper end, so that when it is very short, their insertion is at the base of the corolla. Stamens 4, didynamous, with a 5th staminodium; anthers 2-celled, cells divergent or parallel. Ovary 2-celled, ovules in more than 2 rows in each cell. Capsule cylindrical, valves woody or coriaceous, opening loculicidally in 2 valves, the dissepiment free at the time of dehiscence, transverse with relation to the valves, and before dehiscence attached to their median line. Seeds numerous, flat, with long lateral wings, attached (2 rows in each cell) along two prominent lines (the lines of attachment to the valves) of the dissepiment; embryo flat, cotyledons broad-rotundate, auriculate at the base, radicle short.

Leaves bipinnate; stamens inserted near the base of corolla.	
Pubescent; calyx campanulate, 5-dentate; pod hard, woody, tuberculate, more than 1 in. diam.	1. *S. xylocarpa.*
Glabrous; calyx split into 2 lips; pod slender, coriaceous, ¼ in. diam.	2. *S. amœna.*
Leaves pinnate.	
Calyx spathaceous; stamens inserted near the throat of the corolla.	
Leaflets rotundate, 1 in. long, the lateral short-petiolulate; corolla-lobes oblong, flat; capsule flat, smooth . .	3. *S. falcata.*
Leaflets ovate-oblong, 2 in. long, the lateral long-petiolulate; corolla-lobes rounded, curled; capsule convex, rough .	4. *S. crispa.*
Calyx bilabiate; stamens inserted near the base of the corolla	5. *S. Roxburghii.*

The genus *Spathodea*, as here defined, will certainly not remain undivided, and should be confined to the species with pinnate leaves, racemose flowers, spathaceous calyx, and stamens inserted at the top of a long cylindrical corolla-tube. Whether *S. xylocarpa* and *S. amœna* should be referred to *Radermachera*, Zollinger, to which they approach by their cylindrical dissepiment, I do not venture to decide with the materials before me. In that case *Radermachera* would include a very heterogeneous group with pinnate (*R. stricta*, Zoll.) and bipinnate leaves, with the calyx truncate (*stricta*), split into 2 lips (*gigantea*, Miq., *amœna*), and 5-dentate (*xylocarpa*), not to mention the difference between the thick woody valves of *R. xylocarpa* and the membranous or coriaceous valves of most other species. Another question to be decided is, whether *Heterophragma* is to remain, or, as proposed by Bureau l. c. 50, to be merged in *Spathodea*, from which it differs by the bilabiate calyx and the stamens inserted near the base of the corolla. These considerations have induced me, as a provisional arrangement, to keep the species described below united under the genus *Spathodea*, although they differ in habit and essential characters, and though the name *Spathodea* is not appropriate for all of them.

1. **S. xylocarpa**, T. Anderson.—**Tab. XLIII.**—Syn. *Bignonia xylocarpa*, Roxb. Fl. Ind. iii. 108; Wight. Ill. t. 1336; Bedd. Fl. Sylv. t. 70. Vern. *Kharsing, kharsingi*, Bombay; *Bairsingi*, Khandeish Dangs; *Jaimangal, sondar-pādal*, Mandla, Balaghat, C.P.; *Dhōta mara*, Gonds, Satpura range.

A middle-sized tree. Leaves bipinnate, 1-4 ft. long, glabrous, hard and somewhat rough when full-grown; pinnæ 4-6 pair, pinnules 3-5 pair, short-petiolulate, ovate or ovate-lanceolate, entire. Flowers white, with a tinge of yellow, fragrant, appearing before the leaves expand; pedicels as long as calyx or longer, clustered in bracteate umbellate fascicles, these in terminal, compound trichotomous cymes; bracts oblong, shorter than pedicels, as well as ramifications of inflorescence and calyx soft-pubescent. Calyx campanulate, coloured, with 5 short and unequal teeth. Corolla 2 in. long, oblique, segments nearly equal, curled, cylindrical part of tube very short, stamens inserted near the base, filaments hairy below. Capsule 1 - 3 ft. long, a little curved, hard, woody, very rough, with numerous large, irregular, hard tubercles, somewhat compressed, valves 1¼ - 1½ in. broad, convex, ⅛ in. thick, inside smooth and shining; dissepiment cylindric, grey, shining, attached before dehiscence to the median line of the valves. Seeds numerous, in 4 rows (2 in each cell), flat, slightly curved, ½ in. long, and equally broad, wings delicate, transparent, oblong, 1-1½ in. long from end to end; hilum ¼ in. long, arching.

Common in South India. Khandeish Dangs. Satpura range, Mandla and Balaghat (not common). Fl. April, May, when nearly leafless. The new foliage appears about the commencement of the rains. Fruit takes a year to ripen. Growth said to be rapid.

Attains 30-35 ft. in the Satpura range, but grows into a large tree in the moister forests along the western Ghats. Foliage pale green, resembling that of *Schrebera swietenioides*. Bark light grey, ½ in. thick.

Heartwood light brown, reddish or reddish-brown, close-grained tough and elastic, medullary rays numerous, fine pores in groups, each group in a roundish patch of white tissue.

2. **S. amœna**, A. DC. Prodr. ix. 208.—Syn. *Radermachera amœna*, Seem. Journal of Botany, viii. p. 146; *Bignonia amœna*, Wall. Pl. As. rar. t. 183.

A large tree. Leaves opposite, bipinnate; leaflets ovate-lanceolate, entire, acuminate, glabrous, shining. Flowers large, fragrant, white, orange inside. Calyx bilabiate. Stamens inserted near the base of corolla-tube, anther-cells divergent. Pods rust-coloured, pendulous, slender, linear, 12-18 in. long, valves coriaceous, ¼ in. broad. Seeds (including wings) ½ in. long.

Malay peninsula and Burma, not seldom cultivated in gardens. Fl. Nov.-May.

3. **S. falcata,** Wall.; Bedd. Fl. Sylv. t. 71.—Syn. *Bignonia spathacea,* Roxb. Cor. Pl. t. 144; Fl. Ind. iii. 103. *Dolichandrone falcata,* Seem. Journ. Bot. viii. 340. Vern. *Hāwar,* Oudh; *Kansēri,* Meywar; *Mendal, manehingi,* Banswara; *Mersingi,* Bomb.

A small or middle-sized tree, glabrous or pubescent. Leaves generally opposite, 3-6 in. long, leaflets 2-3 pair, short-petioluled, with a terminal leaflet on petiolule ½ in. long, all rotundate, ½-1½ in. long, obtuse or short acuminate. Flowers white, in few-flowered racemes at the ends of small branchlets. Calyx ½-¾ in. long. Corolla 1½ in. long; limb deeply cleft into 5 subequal, oblong lobes. Capsule flat, curved, smooth, somewhat shining, with wavy longitudinal lines, 10-14 in. long, and ¾ in. broad. Wings of seeds oblong, half the breadth of capsule, and 1¼ in. long.

Oudh. Meywar (Bassi, Santolah, D.B.), Banswara, South India. Fl. May, June; fruit Dec., Jan. Wood light-coloured.

4. **S. crispa,** Wall.; Bureau l. c. t. 27.—Syn. *Bignonia crispa,* Roxb. Fl. Ind. iii. 103; *Dolichandrone crispa,* Seem. Journ. Bot. viii. 340.

A middle-sized tree; glabrous, young shoots pubescent. Leaves opposite, 8-12 in. long, leaflets 5-7, ovate-oblong, acute, petiolules of the lateral 1 in., of the terminal 2 in. long, blade 2-4 in. long. Flowers pure white, fragrant, in terminal, few-flowered racemes. Calyx 1 in. long. Corolla 2½ in. long, limb with 5 broad-ovate lobes with curled edges. Capsule 12-15 in. long, ½ in. broad, valves convex, hard, coriaceous, brown, rough with paler specks.

South India, will probably be found in the Central Provinces. Fl. May-June; fruit ripe Dec. The timber is esteemed in South India for building and other purposes, it is light-coloured and heavy.

5. **S. Roxburghii,** Sprengel.—Syn. *Heterophragma Roxburghii,* DC. *Bignonia quadrilocularis,* Roxb. Cor. Pl. t. 145; Fl. Ind. iii. 107. Vern. *Warras,* Bombay.

A large tree, with a tall stem, and grey bark. Leaves tomentose while young, glabrous afterwards, opposite, but generally approximate near the ends of branches, 1-2 ft. long, lateral leaflets 3-4 pair, serrate, short, the terminal leaflet long petioluled. Flowers light rose-coloured, fragrant, in large terminal erect panicles, ramifications and calyx densely clothed with soft, tawny tomentum. Calyx bilabiate. Corolla campanulate, the stamens inserted at the base of the tube. Capsule erect, straight, 12 in. long, 2 in. broad, ½ in. thick, divided into 4 spurious cells by a 4-winged dissepiment, with a cross-shaped horizontal section.

Godavery forests (Beddome). Western forests from Khandeish to Canara. Fl. March, April.

5. **STEREOSPERMUM,** Chamisso.

Trees, with opposite, imparipinnate leaves. Flowers in terminal panicles. Calyx 5-dentate or 2-5-lobed. Corolla campanulate, limb oblique, lobes equal or bilabiate. Stamens inserted near the base of corolla-tube, didynamous, anther-cells divergent. Ovary 2-celled; ovules in 1 series on each placenta. Capsule linear cylindrical or tetragonous, generally contorted, opening loculicidally in 2 valves, the valves coriaceous, the dissepiment thick, spongy, jointed, entirely filling the capsule, transverse with relation to the valves, and attached before dehiscence to their median line. Seeds wedge-shaped, with a rounded back, the nucleus doubled up between the joints of the dissepiments, radicle and plumula lying along the sharp edge of the wedge, the cotyledons being doubled up outwards; testa spongy or crustaceous, having the appearance of projecting into the seed and dividing it into 2 incomplete cells; wings oblong delicate membranous on 2 sides, attached to the rounded back of the seed.

Pubescent; capsule cylindrical, valves hard thick crustaceous, rough, ¾ in. diameter . . . . 1. *S. suaveolens.*
Glabrous; capsule compressed, valves thin coriaceous, smooth, ¼ in. broad . . . . 2. *S. chelonoides.*

1. **S. suaveolens,** DC.; Wight Ic. t. 1342.—Syn. *Bignonia suaveolens,* Roxb. Fl. Ind. iii. 104. Sans. *Pātali.* Vern. *Pāral; pādal, padiāla, padarīa, parur.* Local names: *Pandri, phāndri,* C.P.

A large tree; pubescent, young parts soft and viscous-tomentose. Leaves 12-24 in. long, leaflets 2-3, rarely 4 pair, shortly, the terminal leaflet longer petiolulate, oval, acuminate, 3-6 in. long, often serrate, with 6-8 pairs of prominent main lateral nerves, joined by obliquely transverse veins. Flowers of a dark, dull-crimson colour, exquisitely fragrant, 1½ in. long, in large, lax, trichotomous viscid panicles. Calyx campanulate, 4-cleft, the 2 upper divisions each with 2 minute teeth. Corolla pubescent, funnel-shaped, limb oblique, bilabiate, the 3 inferior lobes longer, and the edges of all much curled. Capsule cylindrical, dark grey, rough, with elevated white specks, valves thick, hard, crustaceous; 18-24 in. long, and ¾ in. diameter; dissepiment cylindrical, brown, ½ in. diameter. Seeds ½-1¼ in. apart, wedged into narrow notches of the dissepiment.

A common tree in South-, Central-India, Bengal, and Burma. In the sub-Himalayan tract and outer hills ascends to 4000 ft., extends north-west to the Jhelam, and is common as far as the Jumna. Often associated with Sāl. The old leaves are shed in April, the young foliage appearing by the end of that month or early in May. The flowers issue with or before the new leaves, the fruit ripens Nov., Dec., and remains long on the tree. Attains 70-80 ft. in Kamaon, with a tall, fairly straight trunk, to 6 ft. girth, and 30 ft. to the first branch, much smaller in the drier climate of Central India. Bark ⅓-½ in. thick, dark grey or brown, the outer soft corky and darker-coloured layer flaking off in pieces, leaving a fresh smooth light-cinereous surface. "Leaves of young plants harsh and serrated, those of the mature tree soft villous and entire" (R.

Thompson). Sapwood white or yellowish, heartwood with irregular outline, brown or reddish-brown, often mottled with white. 44 lb. per cub. ft., fairly durable, and easy to work. Much valued for building, and generally commands a ready sale. Makes excellent charcoal. Root and bark used in native medicine.

2. **S. chelonoides**, DC.; Wight Ic. t. 1341; Bedd. Fl. Sylv. t. 72.—Syn. *Bignonia chelonoides*, L.; Roxb. Fl. Ind. iii. 106. Vern. *Pader, padel, parrul, padri.*

A large glabrous tree. Leaves 12-18 in. long, leaflets 3-5 pair, elliptic, sometimes serrate, long-acuminate, blade 4-6 in., acumen often 1 in., petiole ⅓-½ in. long; main lateral nerves 8-10 pair. Flowers yellow, fragrant, ½-¾ in. long, in large, loose, trichotomous glabrous panicles. Calyx campanulate, 5-dentate. Corolla campanulate, limb spreading, oblique, lobes nearly equal. Capsule linear, compressed, curved, 12-24 in. long, ½ in. broad, valves convex, coriaceous, smooth. Dissepiment subcylindrical, grey or light brown, with wide open notches for the seeds, which are ¼-½ in. apart.

Common South India, Ceylon, Burma, and Bengal. Gonda forests Oudh, rare, on the driest spurs. The leaves are shed Feb., March, and renewed in April. Flowers appear after the leaves, April-July. Fruit Aug.-Jan., remaining long on the tree. In Oudh a small, elsewhere a large tree, with a tall straight trunk. Bark ½ in. thick, light-cinereous or brown, furrowed longitudinally. Heartwood reddish-brown, orange (Skinner), close-, even-grained, hard, elastic, easy to work, said to be durable. Weight 45 lb. (Kyd), 48 lb. (Sk.), value of P. 710 (Kyd), 642 (Sk.) Used for building, and is a good furniture-wood. Bark, leaves, flowers, and fruit used in native medicine. Flowers used in Hindu temples.

6. **TECOMA**, Juss.

Trees or shrubs, with opposite, simple or digitate leaves. Calyx campanulate, 5-dentate. Corolla campanulate, limb oblique. Stamens inserted in the lower part of the corolla-tube; anthers 2-celled, the cells parallel at first, diverging afterwards. Ovary 2-celled, supported or surrounded by a fleshy annular disc; numerous series of ovules in each cell. Capsule linear, dissepiment transverse, thin, flat, attached before dehiscence to the median line of the valves. Seeds numerous, flat, imbricate, on 3 sides with a thin, white, membranous wing.

1. **T. undulata**, G. Don.—Syn. *Tecomella undulata*, Seem. Journal of Botany, i. 18; *Bignonia undulata*, Roxb. Fl. Ind. iii. 101; *Bignonia glauca*, Decaisne in Jacq. Voy. Bot. t. 142. Vern. *Reodāna, rebdān*, Trans-Indus; *Lahūra, lūar, roīr, rahīra*, Pb.; *Lohūri, lohēro*, Sindh; *Roira*, Mairwara.

A shrub or small tree, glabrous, extremities and young leaves often pubescent with very minute, fasciculate hairs. Leaves generally opposite, subcoriaceous, grey, somewhat rough when old, oblong, linear-oblong, sometimes obovate-oblong, entire, blade 2-4 in., petiole 1 in. long. Flowers very large, bright orange-coloured, inodorous, 5-10, in short corymbs at the ends of short lateral branchlets. Corolla campanulate, 2 in. across. Ovary surrounded by a cup-shaped disc. Capsule curved, 6-8 in. long. (Seemann separates *Tecomella* from *Tecoma* by simple leaves, and Bureau, l. c. 53, agrees with him. The cup-shaped disc is a remarkable character of this species.)

Low hills of Sindh and Beluchistan. Trans-Indus territory, ascending in the Suliman range to 3000, at times to 4600 ft. Panjab Salt range, Siwalik tract, extending eastward to the Jumna. Occasionally in the plains of the Panjab, near Delhi, Cawnpore, in Bandelkhand, Rajputana, Guzerat, and in one place in Khandeish (Graham Bombay, 124).—Arabia. Grown in gardens in Calcutta and Bombay. Evergreen or nearly so in North India, the leaves being renewed in Jan. and Feb. The leaves vary exceedingly in size and shape. In full bloom in March, April, when the tree is a most beautiful sight, especially on the north-west Panjab frontier. Easily raised from seed and cuttings. Coppices well. Fruit ripens May-July. Where protected grows into a handsome tree, 30-40 ft. high, with a stem 12-15 ft. clear, and 5-8 ft. girth, with a fine, rounded, rather open crown, extremities of branches drooping. Generally only a stiff shrub, 8-10 ft. high. Twigs grey, bark of stem ¼-½ in. thick, reddish brown, or dark grey, corky, rough with shallow longitudinal furrows, and ridges between, crossed by short, shallow, transverse cracks, becoming scurfy by age and peeling off. Heartwood dark greyish-brown, often mottled with white. Medullar rays fine, whitish, pores surrounded by patches of whitish tissue. Close- and fine-grained, hard, 44 lb. per cub. ft. Works easily, takes a beautiful polish, tough, strong and durable. Highly prized for furniture, carving-work, and agricultural implements. The leaves are greedily browsed by cattle.

ORDER LX. VERBENACEÆ.

Herbs, shrubs or trees. Leaves simple or digitate, opposite, whorled or rarely alternate, without stipules. Flowers irregular, rarely regular. Calyx persistent, gamosepalous, often enlarged in fruit. Corolla hypogynous, gamopetalous, lobes usually 4 or 5, more or less 2-lipped, imbricate in bud. Stamens inserted in the corolla-tube, usually 4, nearly equal or one pair longer, and when the corolla is regular, as many as lobes and alternating with them; anthers 2-celled, the cells usually parallel and opening longitudinally. Ovary not lobed, or but slightly 4-lobed, 2- or 4-celled, 1 ovule in each cell; style terminal, usually with 2 short stigmatic lobes. Fruit dry or fleshy, indehiscent, or separating into 2 or 4 segments nuts or pyrenes: seeds few, in the Indian species without albumen; embryo straight with thick cotyledons and an inferior radicle.—Royle Ill. 298; Wight Ill. ii. 212.

Fruit a hard bony 1-4-celled endocarp, surrounded by a spongy pericarp, enclosed in an enlarged and inflated calyx; corolla-tube short; leaves entire . . . . 1. TECTONA.

Fruit a dry or fleshy drupe, the entire fruit separating into 2 or 4 pyrenes, supported by an enlarged and often succulent calyx; corolla-tube slender, cylindric; leaves simple . 2. CLERODENDRON.

Fruit a fleshy drupe; calyx not much enlarged; leaves simple.
- Flowers in terminal racemiform panicles composed of lateral cymes; corolla-tube short, with a wide open mouth; style unequally 2-lobed . . . . 3. GMELINA.
- Flowers in terminal trichotomous panicles, or in a spike-like thyrsus; corolla-tube short, campanulate or cylindrical, lobes unequal; style with 2 short acute stigmatic lobes 4. PREMNA.
- Flowers in axillary cymes; corolla campanulate, regular; style dilated and truncate, or shortly 2-lobed . . 5. CALLICARPA.
- Flowers in bracteate heads or spikes . . . . . 6. LANTANA.

Fruit a fleshy drupe; calyx not enlarged; leaves digitate . 7. VITEX.

Fruit dry, dehiscent into 4 one-seeded segments.
- Calyx campanulate; corolla-tube short, limb bilabiate . . 8. CARYOPTERIS.
- Calxy with a large spreading circular limb; corolla-tube cylindric, curved . . . . 9. HOLMSKIOLDIA.

Fruit a 2-valved capsule; calyx 5-sepalous, supported by bracts . . . . 10. AVICENNIA.

1. TECTONA, Linn. fil.

Trees with four-sided branchlets; young shoots and leaves clothed with stellate tomentum. Leaves large, opposite, entire. Flowers in trichotomous panicles. Calyx campanulate, lobes 5-6, imbricate in bud. Corolla infundibuliform, tube short, about as long as calyx, lobes 5 or 6, spreading, nearly equal. Stamens as many as corolla-lobes, exserted. Ovary 4-celled, 1 ovule in each cell; stigma bifid. Fruit an indehiscent, hard, bony 4-celled nut, enclosed in a thick spongy covering, which is surrounded by the enlarged and inflated membranous calyx. Albumen 0; embryo straight, with fleshy, oily cotyledons, and an inferior radicle.

1. **T. grandis**, Linn. fil.—**Tab. XLIV.**—Roxb. Cor. Pl. t. 6; Fl. Ind. i. 600; Bedd. Fl. Sylv. t. 250. *The Teak tree.*—Sans. *Sāka;* Arab. *Sāj;* Pers. *Sāj, sāl.* Vern. *Sāgun,* Hind.; *Sāg, sāgwan,* Mar.; *Tēkku,* Tamil and Malayalim; *Tēku,* Telugu; *Tēgu,* Tulu and Canarese; *Kyūn,* Burm.; *Jāti,* Java.

A large deciduous tree; branchlets four-sided and channelled, with large quadrangular pith. Leaves oval or obovate, blade 1-2 ft. long, 6-12 in. broad, petiole 1-1½ in. long, in seedlings and coppice-shoots the leaves much larger, 2-3 ft. long; upper side rough, under side clothed with dense stellate, grey or tawny tomentum; main lateral nerves prominent, 8-10 pair, with 2 or 3 large branches near the edge of leaf, joined by numerous parallel transverse veins. Flowers white, on short pedicels, in large erect terminal cross-branched cymose panicles 1-3 ft. long, with short lanceolate bracts. Fruit subglobose, more or less indistinctly 4-lobed, ½ in. diam., the thick spongy pericarp consisting of a dense felt of branched hairs; the nut uneven, with 1, 2, 3, rarely 4 seeds, and a central cavity having the appearance of a 5th cell. When the seed germinates, the outer wall of each cell comes off bodily like a round, concave cap. The inflated calyx, enclosing the fruit like a bladder, is generally ovoid, sometimes depressed, reticulate, and more or less crumpled or irregularly plaited, 1-1½ in. diam.

The Teak tree is indigenous in both peninsulas of India, in the eastern drier part of Java, in Sumatra, and in some of the other islands of the Indian Archipelago. In Western India it does not extend far beyond the Mhye. In Feb. 1870 I found it in the Sadri or Santola forests a few miles north of that river, about 20 miles south-west of Neemuch. In Central India it attains its northernmost point in the Jhansi district at lat. 25° 30′, and from that point the line of its northern limit continues in a south-easterly direction to the Mahanadi river in Orissa. In Burma proper, Teak is known to extend to the 25th degree N.L., and it is reported from Munipur at about the same latitude. There is no proof of its being indigenous in Bengal, though there is a report of its having formerly been found wild in Assam, between Tezpur and Bishnath. It is, however, cultivated throughout Bengal, Assam and Sikkim, and in north-west India, without difficulty, as far as Saharanpur. In the Panjab it is difficult to raise, and it has not been grown west of Lahore. As regards moisture, Teak seems to require a rainfall of 30, but to thrive best under a mean annual fall of 50 to 120 inches.

The temperature of the Teak-producing districts may be illustrated by the following statement of the mean temperature during the four seasons at the following stations,—four of which, Cannanore, Bombay, Rangoon, Toungoo, represent a climate where the tree thrives to perfection ; and three, viz., Baitul, Nursingpur, and Sagar, being situated near the northern limit of its area.

		Cannanore.	Bombay.	Rangoon.	Toungoo.	Baitul.	Nurs.	Sagar.
Dec., Jan., Feb.,	mean,	80·0	75·7	75·6	72·4	60·8	62·4	64·5
March, April, May,	"	84.4	83.0	80.7	84.3	80.0	80.6	83.5
June, July, Aug.,	"	78.9	81.8	80.1	80.4	77.6	82.5	86.4
Sept., Oct., Nov.,	"	79.9	80.7	80.9	78.6	71.8	75.9	72.8
Year,	"	80.8	80.3	79.3	78.9	72.5	75.4	76.8

Thus it may be said that the Teak tree thrives with a mean temperature during the cold season between 60° and 80°, during the hot season between 80° and 85°, during the rains between 77° and 87°, during autumn between 71° and 81°, and that the mean annual temperature which suits it best lies between 72° and 81°. The absolute extremes of the Teak districts are illustrated by the following statement of maximum and minimum temperatures observed at three of the above-named stations during the 12 months of the year :—

	NURSINGPUR.		RANGOON.		BOMBAY.	
	Min.	Max.	Min.	Max.	Min.	Max.
Jan.,	39°	84°	62°	92°	60°	88·2
Feb.,	48	92	59	97	68.8	87.2
March,	58	96	64	100	67.2	93.3
April,	65	102	75	100	74	93.2
May,	74	104	73	95	79.3	94.2
June,	77	106	75.5	90	76	95.3
July,	78	99	75	89	75.8	89.4
Aug.,	73	91	76	88.5	74.4	89.2
Sept.,	67	91	76	96	75	88.3
Oct.,	60	92	74	92	73	92.5
Nov.,	60	79	69.5	90.5	71.6	91.5
Dec.,	47	75	62	90	66.2	90.8

Teak, however, can bear temperatures considerably lower than those indicated by these figures. In the valleys of the Satpura range and on the Mhye river in Western India frost is not uncommon in the Teak-producing districts. In Burma, Teak ascends to 3000 ft. in the hills east of Toungoo, and in a few other places, but does not attain large size at that elevation ; and in the Pegu Yoma hills, a different description of forest, composed partly of evergreen trees with a great deal of *Xylia dolabriformis*, takes the place of Teak at elevations above 2000 ft. On the Anamallay mountains it grows to perfection at about

2500 ft. (Beddome Fl. Sylv.), and many of the best Teak forests of Western India above Ghat in Wynaad, Coorg, and North Canara, are above 2000 ft. Beddome states that on the mountains of the peninsula it rises to a little above 4000 ft., but at any elevation above 3000 it is of poor growth.

Teak grows on a great variety of soils, but shows a decided preference for certain descriptions. In Burma it thrives best on the sandstone of the Pegu Yoma; there it forms tall, straight, and regularly-shaped stems, and natural reproduction from self-sown seedlings is fairly good. But it thrives equally well on the granite of the eastern Sitang forests, and the splendid forests of North Canara have granite as the underlying rock. Again, some of the finest Teak localities in the Thoungyeen district of Tenasserim are upon limestone, and in some of the dells and valleys of the Khandeish Dangs the tree grows to great perfection on soil produced by the disintegration of basaltic rocks. Thus we find Teak on light and sandy soils, as well as on those which are binding and heavy. But under all circumstances there is one indispensable condition, perfect drainage and a dry subsoil. To the absence of perfect drainage I ascribe the circumstance that Teak does not seem to thrive on level ground with alluvial soil. Instances of natural Teak forests in such localities are found on the headwaters of the Beeling and Domdamee rivers in Martaban, in the lower Bonee forests, and in some other places in the plains of Pegu. In such soil the Teak grows freely and rapidly—more rapidly than on the hills—but the trunks are irregular, fluted, and ill-shapen; while on the adjoining hills the tree habitually forms tall, clean cylindrical stems.

It is remarkable that the only pure or nearly pure natural Teak forests which are known are found on alluvial soil. Otherwise, the tree, though gregarious, is always associated with Bamboos and trees of other kinds, often forming a small proportion only of the forest. Thus in the better Teak localities of Burma, Teak is estimated to form about one-tenth; but the proportion of Teak to the trees of other kinds fluctuates exceedingly: sometimes it equals their number; in other instances, again, it does not form one-hundredth part of the trees in the forest. The associates of Teak are, besides Bamboos, the ordinary trees of the dry forest. To a certain extent these vary in different parts of India, but the following kinds may be regarded as the usual companions of Teak: *Schleichera trijuga, Dalbergia latifolia, Ougeinia dalbergioides, Cassia Fistula, Pterocarpus Marsupium, Terminalia tomentosa, bellerica, Anogeissus latifolia, Lagerstrœmia parviflora, Diospyros Melanoxylon, Gmelina arborea, Briedelia retusa,* and to these must be added, in Burma and in some forests of the peninsula, *Pterocarpus indicus, Xylia dolabriformis, Anogeissus acuminata,* several species of *Sterculia, Eriolæna, Premna,* and *Cordia.* On alluvial soil in the plains Teak is often associated with *Careya arborea, Adina cordifolia, Stephegyne parvifolia,* and (in Burma) with *Lagerstrœmia Reginæ.* Teak is hardly ever found in Sāl forests, and but rarely in the Ein forest of Burma (*Dipterocarpus tuberculatus*). Nor is it a denizen of the evergreen forest of Burma and the Western Ghats, though there are a few instances on record (in the Attaran and Thoungyeen forests of Tenasserim) where the evergreen forest has, probably owing to a cessation for a series of years of the annual forest-fires, extended itself into a Teak locality, and in such cases the Teak has been drawn up to a great height by the rapid growth of the surrounding evergreen trees, being fed at the same time by the constantly increasing fertility of the soil. For there is a vast difference between the moist and loose black soil of the evergreen forest, which is enriched year after year by the products of the gradual decomposition of leaves, branches, and other debris of the forest, and the barren soil of the dry forest, where the whole of the annual fall of leaves and branchlets is annually consumed by the jungle-fires, and the ashes, instead of affording nourishment to the trees, are washed away by the first rush of the rains. Seedlings, however, are wanting where Teak grows up under such conditions. For the Teak is eminently a light-requiring tree, analogous in that respect to the Oak and Scotch Fir—light overhead and free circulation of air being two conditions indispensable for the development of Teak seedlings.

In dry and hot situations, the Teak loses its leaves in November, December, or early in January; but where the ground is moist, the tree often remains green until Feb. or March. The new foliage comes out in May.

Teak flowers during the rains, in July and August, and ripens its seed between November and January. In summer it is readily recognised at a considerable distance by the whitish flower-panicles, which overtop the green foliage; and in winter, the feathery erect fruit-panicles distinguish it at the first glance from all other trees. One of the greatest obstacles to the spread of the Teak is the circumstance, that the seed ripens and falls to the ground at the commencement of the hot season, before the annual fires pass through the forest. The tree produces seed at an early age, and generally seeds freely and regularly every year; but a large proportion of the seeds are destroyed by the fires, and of those which escape numbers are washed away, in the hills at least, by the first torrents of the monsoon. The germination of the seed is slow and somewhat uncertain; a large amount of moisture is required to saturate the spongy covering, and for this reason it has been found useful, where Teak is cultivated, to soak the seeds in water for some time before sowing them. At the time of germination, the expanding embryo bursts open the caps or valves of the fruit, and two or three plants not rarely spring from one nut. When the seed is sown in nurseries, it generally takes about a fortnight before the first seedlings show themselves above ground, and they continue coming up successively for a considerable period, numerous seedlings appearing during the second and third year, and a large proportion not germinating at all. The seedlings have a long taproot, which during the first two or three years is often as long as the stem above ground. The root is soft, almost fleshy, and seedlings are very sensitive to any injury of their roots, differing in this respect entirely from Oak seedlings, which are in no way injured by the shortening of their taproot. Teak seedlings, therefore, are as a rule best transplanted the same season in which they are raised.

During the early period of its life the growth of Teak is exceedingly rapid. As an instance, I may mention the Thinganneennoung plantation on the Upper Winyeo river (Attaran) in Tenasserim. Here a large nursery was established on rich soil (the site of an old evergreen forest) in March and April 1856, and in July 1858 I counted on a plot (28 ft. wide and 66 ft. long, or 1848 sq. ft.) 841 plants,—of which 17 were 27-32 ft. high, with a girth, at 1 ft. above the ground, between 9 and 13 in.; 70 were 20-27 ft. high, with a girth of 6-9 in.; and the rest, viz., 754 plants, were less than 20 ft., with a girth under 6 in., the large number of small and oppressed plants being due to the circumstance that seedlings had neither been taken out for transplanting nor had they been thinned. Under favourable circumstances, trees attain a girth of 18 in. (at 6 ft. from the ground) in 10-15 years; after that the growth slackens, and a girth of 6 ft. is not generally attained under 100 years. The following figures illustrate the average rate of growth at the Nelambur plantation in Malabar, on favourable soil and in a moist, hot, forcing climate. From a survey made of it in 1868 by Captain W. Seaton, Conservator of Forests, British Burma, the circumference was measured at 6 ft. from the ground.

870 trees per acre, 6 years old, 37 ft. high; average girth 12 in., maximum 20 in.
476 „ 12 „ 45 „ „ 16 „ „ 31 „
195 „ 24 „ 65 „ „ 29 „ „ 60 „

This is the oldest large Teak plantation in India; it was commenced in 1844 by the late Mr Conolly, collector of Malabar. These results are borne out by the experience of Teak planting in Burma, which, however, does not go farther back than 1856. Thus the average girth of trees in plantations 4 years old (580-660 trees per acre), in the Rangoon, Toungoo, and Tharawaddee district, has been found to vary from 5 to 9 in., the maximum being 14 in., while their average height was between 15 and 27 ft. Plantations 10 years old show an average girth of 15 in., and a height of 40-45 ft.; and trees 15 years old at Prome have attained a girth of 23 in., the largest measuring 32 in. In order to obtain a basis for regulating the working of the Teak forests in Burma in 1856, I collected all data which were available at that time, and based upon them the following estimate, which is placed side by side with a modified estimate, framed in 1868, to serve as the basis of a revised working plan of those forests.

Girth at 6 ft. from ground.	Age, estimated in 1856.	In 1868.
18 in.	10 years.	19 years.
36 „	22 „	46 „
54 „	37 „	88 „
72 „	62 „	160 „

The first of these estimates was mainly based upon the growth of trees planted in gardens of Calcutta and Moulmein, and upon information obtained from Bombay and Java (Report on the Teak Forests of Pegu for 1856, p. 75, 76); and the revised estimate was based upon additional data obtained by periodical measurements of trees in the Thoungzay and Thoukyeghat forests of Pegu, and by the examination of the annual rings. The plantations of Burma and Malabar, on good soil and under otherwise favourable circumstances, may possibly attain the rate of growth of the first estimate; but in the natural forests, where the soil, instead of being enriched by the decomposition of leaves and branchlets, is impoverished by the annual fires, the rate of growth will probably be found to approach more nearly to the later estimate. These remarks relate to the Teak in Burma and South India; regarding the rate of growth in the dry and hot hills of Central India, within the range of this Flora very little is known. The experience hitherto gained in the plantations made since 1867 in the Satpura hills of the Central Provinces seems, however, to show that with care and water the plants make fair progress during the first 5 years, the difficulty being that frost and drought kill a large proportion. In the Teak forests of Java the growth is stated to be very rapid; the trees are generally felled at the age of 40-50, and at 100 years they are said to attain a diameter of 4 ft.

Teak has a powerful terminal shoot, and this is an important point in its favour, as the young Teak is thus able to pierce through the thicket of other trees and Bamboos, and to seek the light which it absolutely requires for its development. In this respect there is considerable analogy between the Teak and the Ash (see p. 304). Teak, like many other trees, attains nearly its full height during the early part of its life. It is probable that, as a rule, the tree attains half its length with a girth of 2-3 ft., and that it does not considerably increase in height after it has attained a girth beyond 5 or 6 ft. 120-150 ft. is probably the greatest height which a Teak tree in its natural home, the dry deciduous forest, ever attains, and stems more than 100 ft. long to the first branch are not often found. The largest number of tall stems which I have ever seen were in the Gwaythay forests, east of the Sitang river above Toungoo, on granite rock. The following is an abstract of the measurements taken by me there in March 1861:—

Girth at 6 ft. from ground,		length of stem to first branch,	
Girth at 6 ft. from ground,	8 ft.;	length of stem to first branch,	72 ft.
„ „	7 „	„ „	106 „
„ „	8 „	„ „	106 „
„ „	16 „	„ „	114 „
„ „	9 „	„ „	78 „

On the Anamallays Beddome records trees with a girth of about 22 ft., and a straight trunk of some 80 or 90 ft. to the first bough. In the North Canara forests clear stems 70-80 ft. long are not rare; in the Ahiri forests, lat. 19° 30′, Col. Pearson reports stems 60-70 ft. high; and even considerably farther north in the Khandeish Dangs, lat. 20° 45′, I have measured clear stems 60-70 ft. long to the first branch. Teak attains a large diameter, girths of 10-15 ft. are not uncommon, and numerous instances of 20-25 ft. are on record. The forest tracts, however, in India which now contain Teak of such dimensions, are neither numerous nor extensive. The Teak forests richest in large timber on the west side of the Peninsula are the Travancore, Anamallay, Wynaad, South-West Mysore, and North Canara forests. The Dangs at the foot of the Khandeish Ghats also have a considerable quantity of large timber. In the centre of the Peninsula are the Godavery forests, of which Ahiri, east of the Pranhita river, near the foot of the third barrier, is the most compact and valuable.

In British Burma, the sandstone hills of the Pegu Yomah, the outer valleys on both sides of the mountain-range which separates the Sitang and Salween rivers, and the Thoungyeen valley, contain the best Teak localities. Teak, however, is far more abundant beyond the frontier, in Burma proper on the tributaries of the Irawaddi, and the headwaters of the Sitang river, in the Karenee country, the Shan States tributary to Burma, and in Siam on the feeders of the Salween, Thoungyeen, and Meinam rivers.

It is estimated that the Teak plantations of Burma, when mature, will contain at the age of 80 years about 60 trees per acre, measuring on an average 6 ft. in girth, and yielding 3000 cub. ft. of marketable timber, which, with the thinnings, is expected to amount to a mean annual yield of 47 cub. ft. per acre (Report on the revised plan of working the Burma forests of Feb. 1868). The natural Teak forests, not being pure or compact, do not distantly approach to this yield. As an instance of a particularly rich forest, I may quote Col. Pearson's survey of a sample acre in Ahiri, stocked with 18 large trees, containing an aggregate of 22 tons, or 1100 cub. ft. of timber. Most of these trees, however, were probably more than two centuries old. The following figures, taken from official reports, illustrate the average quantity of Teak standing on the ground in forest tracts which are fairly well stocked :—

	Area Surveyed.		Trees counted on 100 Acres.				
			Above 6′g.	4′6″ to 6′g.	Below 4′6″g.	Total.	
1869-70.	Ahiri (Bemaram)	19 sq. m.	482 20	373 58	1332 389	2187 467	Teak. Blackwood.
,,	,, (Mirkullu)	18 ,,	185 26	229 43	644 208	1058 277	Teak. Blackwood.
1856-67.	British Burma	93 ,,	170	112	512	794	Teak.
1868.	Pegu	2 ,,	149	120	1419	1688	Teak.
1870-71.	Pegu (Prome dis.)	17 ,,	364	302	2158	2824	Teak.
1871-72.	,, (Tharawaddi)	8 ,,	137	152	610	899	Teak.

A portion of the Ahiri forests (on the hills) contains Teak, Blackwood (*Dalbergia latifolia*) and Bamboos only; the forests in Burma contain a variety of trees besides Teak and Bamboo.

A great proportion of the Teak on the Kymore and Satpura ranges consists only of coppice-wood. The same may be said of most Teak forests on the dry hills of the Dekkan, and of the Konkan Teak forests a great portion consists of coppice-woods. Teak has great powers of reproduction, it coppices vigorously, and the shoots grow with great rapidity, much more rapidly at first than seedlings. This great power of reproduction is another point which favours Teak in its struggle of existence against other trees, for most Teak seedlings which come up naturally are cut down to the ground by the jungle-fires of the hot season: some are killed, but many sprout again during the rains; and though they are cut down repeatedly by the fires of successive seasons, yet meanwhile the root stock increases in size every year by the action of the shoots which come up, and at last, often after the lapse of many years, it produces a shoot strong enough to outlive the fire. Thus in many cases what appears a seedling plant of Teak is really a coppice-shoot from a thick gnarled root-stock, bearing the scars of successive generations of shoots, which were burnt down by the annual fires. The coppice-shoots of Teak attain a large size, and form good serviceable timber.

The bark of the stem is about ½ in. thick, grey or brownish-grey, with shallow longitudinal wrinkles or furrows, peeling off in long narrow thin pieces. The sapwood is white, narrow; the heartwood, when a green tree is cut, has a pleasant and strong aromatic fragrance, and a beautiful dark golden-yellow colour, which on seasoning soon darkens into brown, mottled with darker streaks. The timber retains its aromatic fragrance to a great age, whenever a fresh cut is made. It is marked by large pores, mostly single, rarely in groups of 2-3, unequal in size, and unequally distributed, more numerous and larger in the inner part of each annual ring (the spring wood), less numerous and smaller in the outer belt; the medullary rays are fine. On a vertical section the pores are distinctly marked. The annual rings of Teak are fairly distinct. When collecting the data in 1856 for the first regular plan for working the British Burma forests, I was doubtful whether the concentric rings visible in the wood corresponded with the annual increment of the tree. This question has now been set at rest by the examination of sections of numerous trees of known age, grown in gardens and plantations, and they may now be taken as a safe guide for determining the rate of growth of the tree. The average weight of seasoned Teak fluctuates between 38 and 45 lb., and the value of P. between 500 and 700. The experiments on record tend to show that the Burma wood is somewhat lighter than the wood from the Anamallays, Malabar, and other forests on the west side of India; but the weight of timber depends so much upon the degree of seasoning, that in order fully to establish a difference in the weight of the wood produced in different forest tracts, fresh comparative experiments with timber, dried artificially in the same manner, will have to be made. The following is a brief abstract of the results of the experiments at present available, omitting those where one or two experiments only are on record:—

Burma,	94 exper.	by various authors,	weight 42.63 lb.,	value of P.	651
Western coast,	14 ,,	,,	,, 44.41 ,,	,,	665
Nagpore,	4 ,,	Capt. Fowke,	,, 41.10 ,,	,,	472
Half-seasoned timber from different sources, 4 exp.			46.81 ,,	,,	591

The first item includes 18 exp. made by me in 1864 at Calcutta, with the assistance of Mr Clifford and Baboo Tincowry Ghose, giving an average weight of 40.24 lb., and value of P. = 567, as well as 46 exp. made by us in 1865, giving 37.71 lb., and 654 as the average value of P. A series of interesting experiments made by Capt. Simpson with different descriptions of Teak imported at Moulmein, is recorded in Balfour's Timber Trees, 2d edit., p. 276, of which the following is an abstract:—

Good timber, killed (by girdling),	13 exp.,	weight 43.5 lb.,	value of P.	478
Young timber, ,, ,,	4 ,,	41.8 ,,	,,	660
Large (old), ,, ,,	8 ,,	38.0 ,,	,,	591
Dead timber (nathat), not killed,	5 ,,	39.5 ,,	,,	631

The difference in these results may to a certain extent be accidental, for the variations in different specimens of timber from the same source are very great; but the fact that the timber of old trees, and of trees which had died naturally, is lighter than that of younger trees, seems not unlikely. In conclusion, the result of Skinner's experiments should be mentioned:—

Malabar Teak, weight 45 lb., value of P. 814
Moulmein „ „ 43 „ „ 809
Pegu „ „ 37 „ „ 736

Unseasoned wood he makes 55-60 lb., but the weight of green Teak is considerably higher. The transverse strength of Teak is nearly the same as that of British Oak, but considerably less than that of either Sāl or Sissoo; compared with these, Teak may be called brittle. Its weight is moderate as compared with most of the more useful Indian woods, the Conifers of course excepted. It does not, however, float unless thoroughly seasoned, and for that reason a peculiar mode of seasoning by girdling is practised in many Teak-producing tracts from which the timber is exported by floating.

Girdling consists in making a deep circular cut through the bark and sap into the heartwood, so as completely to sever the communication between the bark and sapwood above and below the cut. The girdled tree dies after a few days if the operation has been effectually performed; but if even the smallest band of sapwood is left, connecting the outer layers of wood above and below the girdle, the tree is not killed, and often recovers completely, one side of the trunk being clothed again with fresh bark. The girdled tree is allowed to stand one or two years, and often longer if a large tree, and being exposed to the wind and to the action of the sun, seasons more rapidly and more completely than a tree that has been felled green. Girdling is an old custom in Burma and Travancore, and it was formerly practised further north in some of the forests below Ghat on the western coast. Timber seasoned in this manner is generally drier, and lighter than timber felled green. Girdling is not now practised in the Anamallay, Wynaad, Mysore, and Canara forests, whence most of the Teak commonly known as Malabar Teak is obtained; and this circumstance may account for the greater weight of Teak from the western coast as compared with Burma Teak. It may here be mentioned that most trees with a distinctly marked heartwood may be killed by girdling, but that the effect is very slow upon trees which have no distinct heartwood, such as the species of *Nauclea*, *Hymenodictyum*, *Ficus*, &c.

One of the most valuable qualities of Teak timber is, that once seasoned it does not split, crack, shrink, warp, or alter its shape. In this respect it is far superior to Sāl, works easily and takes a fine polish, the wood of stems which have grown up isolated with strong and numerous side branches being often beautifully mottled. But its principal value is its great durability, which is greater than that of most Indian woods. In contact with iron, neither the iron nor the Teak suffers, and in this respect it is far superior to Oak. White ants eat the sapwood, but rarely attack the heartwood of Teak. It does not, however, resist the attacks of the Teredo navalis. The great durability of Teak is, probably with justice, ascribed to the circumstance that the wood contains an aromatic oil, which gives it a peculiarly pleasant smell and an oily surface when fresh cut. In Burma this oil is manufactured on a small scale, to be used medicinally, by filling an earthen pot, which is placed inverted upon another, with chips of wood, and putting fire round it, upon which an oily substance trickles down into the lower vessel. Shipbuilders in English dockyards are of opinion that the Teak which was brought to England in former years was more oily than that now imported, and that pieces of Teak taken out from old ships are more oily when cut than the Teak which is imported at the present time. As nearly all the Teak now comes from Rangoon and Moulmein, and as a considerable proportion of the Teak imported in former years came from the western coast of India, it is not improbable that the circumstance mentioned above has something to do with this difference—viz., that the Burma Teak is killed by girdling, whereas the Teak imported formerly from Malabar had for the most part been felled green. This supposition is confirmed by the circumstance that a considerable portion of the timber formerly exported from Rangoon consisted of large planks (Shinbyin) not sawn, but split from green trees. It has even been asserted that the Teak trees in Burma are tapped for oil, but this is not the case; and the idea probably originated in the circumstance that wood-oil is largely obtained in Burma by the tapping of several species of *Dipterocarpus*. It will, however, require direct experiments to establish the fact that the wood of girdled trees contains less oil than the wood of trees felled green.

The great drawback of Teak is, that the centre of the heart is rarely sound, but that a more or less irregular hollow, often surrounded by unsound wood, runs along the axis of the tree. This peculiarity Teak has in common with other Indian woods, but perhaps to a somewhat greater extent. The mischief is probably mainly caused by the annual fires, which scorch and often burn the bark of young trees, for it is well known that all such external injuries are apt to induce decay in the heart of the tree. An additional cause in the case of Teak may be the large mass of pith in the centre of young stems, and particularly in coppice-shoots, which, as explained above, are the beginning of most Teak trees in the natural forests of India. This supposition, however, requires confirmation by further researches; at present it is nothing but a surmise which appears to have some probability. So much appears certain, that a very rapid growth of the tree during its first few years in Teak plantations is no matter for congratulation, for in such luxuriant shoots the pith is often ½ in. square or more, and it is often inhabited by insects, which bore through from the outside, admitting air and foreign substances, and thus facilitate decay. The comparative value of rapidly and slow grown Teak has not yet been determined in a satisfactory manner. It is well known that the rapidly-grown Oak produced on alluvial soil in South and Central Europe is for many purposes considered equal, if not superior, in value to the slow-grown timber of Northern France and Germany, or of England. It seems, however, to be a fact, established by experience at the Bombay dockyard, that the fast-grown saplings of the Malabar plantations are less valuable for oars than the slow-grown poles produced in the coppice-woods of Severndroog and Colaba.

The various uses of Teak are well known. In India, Teak is prized for construction and shipbuilding beyond any other timber, though for certain purposes other woods are preferred. In Europe it is used for railway-carriages, for the decks of ships, and the backing of ironclads; and the demand for this excellent timber has in no way been diminished by the circumstance that iron has superseded timber for the building of ships generally. Rangoon and Moulmein are at present the principal places whence Teak is exported, and the following statement shows the quantities of Teak timber, in loads or tons of 50 cub. ft., brought to those two ports from the interior during the last five years for which data are available:—

	From British Forests.	Foreign.	Total.
	Tons.	Tons.	Tons.
1867-68, ...	33,104.	88,018.	121,122.
1868-69, ...	52,258.	76,903.	129,161.
1869-70, ...	39,843.	52,157.	92,000.
1870-71, ...	57,086.	82,484.	139,570.
1871-72, ...	52,125.	98,409.	150,534.

The leaves of Teak are used as plates, to wrap up parcels, and for thatching; they contain a red dye. The wood rubbed with water on a stone to the consistence of a thin paste, allays the pain and inflammation caused by handling the black varnish (*Thit-si*) of *Melanorhœa usitatissima*. Flowers and the young fruit are believed to be diuretic (Pharm. Ind. 164).

2. CLERODENDRON, Linn.

Shrubs or small trees, rarely herbs. Leaves simple, opposite or in whorls. Calyx 5-toothed or 5-lobed, enlarged, often enclosing the fruit. Corolla-tube slender, limb spreading, lobes 5, equal. Stamens 4, exserted, often very long. Ovary 4-celled, 1 ovule in each cell; style filiform, with 2 short acute stigmatic lobes. Fruit a more or less succulent or almost dry drupe, the endocarp or the entire fruit separating into four 1-celled, or two 2-celled pyrenes. Albumen none, radicle inferior.

Leaves broad, the length not twice their breadth, petioles more than quarter the length of blade.	
Calyx cleft half-way; fruit dry; leaves small, rhomboid .	1. *C. phlomoides.*
Calyx cleft nearly to the base; fruit fleshy; leaves large, cordate	2. *C. infortunatum.*
Leaves ovate or oblong, petioles short; calyx truncate or with short teeth.	
Corolla white, tube 1 in. long, many times longer than calyx	3. *C. inerme.*
Corolla blue, tube short, not more than twice the length of calyx	4. *C. serratum.*
Leaves linear-lanceolate, subsessile; calyx cleft half-way, corolla-tube 2-3 in. long	5. *C. Siphonanthus.*

1. **C. phlomoides**, Linn.; Wight Ic. t. 1473; Roxb. Fl. Ind. iii. 57. —Vern. *Urni*, North India; *Irun*, *arni*, Guzerat.

A tall pubescent shrub, branches cinereous. Leaves rhomboid, 1-2 in. long, petiole 1 in. Flowers white, fragrant, on slender pedicels, as long as calyx, in a terminal leafy rounded panicle, composed of axillary 3-9-flowered cymes. Calyx campanulate, cleft half-way down. Corolla-tube 1 in. long. Fruit black, nearly dry, with 4 kernels.

Common in many parts of India, principally in the drier regions. Panjab, Sindh, Mairwara, the Dekkan, Behar, Bengal. Oudh and the Central Provinces. Ceylon. Fl. nearly throughout the year.

2. **C. infortunatum**, Linn.; Wight Ic. t. 1471.—Syn. *Volkameria infortunata*, Roxb. Fl. Ind. iii. 59. Vern. *Bhānt*, *bhat.*

A small shrub, branches and under side of leaves soft-tomentose. Leaves cordate or ovate-cordate, entire or dentate, 6-9 in. long, petiole 1-3 in. Flowers white, tinged with red, on short pedicels, in terminal rounded trichotomous panicles, bracts minute. Calyx cup-shaped, cleft to near the base, lobes lanceolate. Corolla-tube ¾ in. long. Berry fleshy, slightly 4-lobed, subglobose, somewhat depressed, ⅓ in. diam., black, shining when ripe, and enclosed in the enlarged, red leathery calyx.

Common as underwood in forests, and under the shade of isolated large trees throughout South and Central India, Bengal, and Burma. Oudh forests, very abundant in the Sāl forests of Kheree, where it attains 12 ft. Sāl forests of Kamaon and Garhwal. Fl. Dec.-April.

3. **C. inerme**, Gärtn. de Fruct. et Sem. i. t. 57; Roxb. Fl. Ind. iii. 58; DC. Prodr. xi. 660.

A large, often scandent, glabrous shrub. Leaves opposite ovate or elliptic, entire, acuminate, subcoriaceous, shining; blade 2-3 in., petiole ½ in. long. Flowers white, in axillary, pedunculate, 3-9-flowered cymes. Calyx campanulate, nearly truncate, with 5 short acute teeth. Corolla-tube 1 in. long. Fruit dry, pear-shaped, 1 in. long, separating when ripe into four 1-seeded segments.

Common along the sea-coast of Bengal and the peninsula, probably also in Sindh. A widely-spread sea-coast plant. Ind. Archip., Australia, China. Fl. nearly throughout the year. Often planted as a hedge in gardens.

4. **C. serratum**, Spreng.; Wight Ic. t. 1472.—Syn. *C. ternifolium*, D. Don. *Volkameria serrata*, Linn.; Roxb. Fl. Ind. iii. 62. *V. farinosa*, Roxb. ibid. 64. Vern. *Barangi.*

A large shrub, youngest shoots and inflorescence pubescent. Leaves glabrous, opposite, or in whorls of three, oblong, elliptic-oblong, oblanceolate, serrate, shortly petiolate, 4-8 in. long. Flowers blue, in a terminal thyrsus, cylindrical in flower, pyramidal in fruit, composed of short lateral trichotomous cymes. Bracts ovate, bractlets lanceolate. Calyx campanulate, truncate or with 5 short teeth. Corolla-tube short, not more than twice the length of calyx, mouth oblique. Berry succulent, ¼ in. across, shining black when ripe, lobed, with 1-4 lobes.

Himalaya from the Sutlej to Assam ascending to 5000 ft. Kasia hills, Nilgiris and Western Ghats. Fl. May-Aug.

5. **C. Siphonanthus**, R. Brown; Wight Ill. t. 173.—Syn. *Siphonanthus indica*, Linn.; Roxb. Fl. Ind. iii. 67. Vern. *Barangi.*

A large glabrous shrub, branches herbaceous, hollow, channelled. Leaves in whorls of 3-5, linear-lanceolate, subsessile, pale beneath, 6-9 in. long. Flowers white when first opening, gradually changing into cream colour, in a large terminal loose thyrsus, composed of pedunculate cymes in the axils of leaves. Calyx campanulate, cleft half-way into 5 ovate segments. Corolla-tube slender, 2-3 in. long, curved. Berries 1-4, ovoid, dark blue, joined at the base, and supported by the enlarged, spreading red calyx.

Cultivated in gardens throughout India. Wild in Kamaon, Bengal, Burma, and the Dekkan. Fl. hot season and autumn. Root and leaves used in native medicine.

3. GMELINA, Linn.

Trees or shrubs with undivided leaves. Calyx 4- or 5-toothed. Corolla-tube short, widening gradually into a wide open mouth, limb oblique, with 4 or 5 spreading unequal lobes. Ovary 4-celled, 1 ovule in each cell; style filiform, unequally 2-lobed. Fruit a succulent drupe, with a hard 1-4-celled kernel. Seeds solitary in each cell, exalbuminous.

An unarmed tree, with cordate leaves	1. *G. arborea.*
A spinescent shrub, with ovate leaves	2. *G. asiatica.*

1. **G. arborea**, Roxb. Cor. Pl. t. 246; Fl. Ind. iii. 84; Wight Ic. t.

1470; Bedd. Fl. Sylv. t. 253.—Vern. *Gumhār, khammara, kambhar, kūmār, gambari.* In Western and Central India: *Sēwan, shewan.*

A middle-sized or large tree, pubescent. Leaves tawny tomentose underneath while young, cordate or broad-ovate, acuminate, with a rounded or cordate base, blade 4-8 in. long, 3-6 in. broad, petiole more than half the length of leaf. Flowers pentamerous, yellow, tinged with brown, in terminal and axillary racemiform panicles composed of lateral cymes; inflorescence, calyx and corolla clothed with dense soft tawny tomentum. Corolla 5-lobed, 2-lipped. Drupe ovoid, smooth, yellow when ripe, 1 in. long.

A widely-spread tree through the greater part of India, Burma, and Ceylon. In the sub-Himalayan tract it extends to the Chenab, ascending to 3000 ft. and even higher, but is scarce in the Panjab. Grows on the dry hills of the Aravalli range near Ajmir. Not gregarious, and nowhere abundant. The leaves are shed Feb.-April, the new foliage appears April-May. Fl. generally before the leaves, Feb.-April. Fruit ripens May-June. Readily raised from seed, growth rapid, 3 rings per in.

Attains 60 ft. and 6 ft. girth in Oudh and Central India, but grows to be a much larger tree in Bengal and Burma. Stem erect, attaining 30 ft. to the first branch, not very regularly shaped. Bark grey, or greyish brown, smooth, or scurfy, at last exfoliating in broad, irregular, thick, scurfy flakes, leaving exposed the fresh, light-coloured, smooth surface. Branchlets ash-coloured, smooth, with white specks. Wood whitish or pale-yellow, strong and close-grained, but not heavy. 30-40 lb. per cub. ft. Does not crack, warp, or shrink in seasoning, is easily worked, takes paint and varnish readily. Lasts well under water, also in tidal streams, better than Teak (Roxb.) Highly esteemed for planking, furniture, the panels of doors, carriages and palankins, well-work, for decks of boats, for toys, lacquered boxes, and all kinds of ornamental work. The fruit is eaten by the Gonds of the Satpura, who protect this tree near villages; deer feed on it. Fruit, root, and bark are used in native medicine.

2. **G. asiatica,** Linn.; Roxb. l. c. 87; Wight Ill. t. 174.

A large branching shrub, with spinescent branchlets. Leaves ovate, pubescent when young, glabrous afterwards. Flowers yellow, tetramerous, in racemiform panicles at the ends of branches. Calyx and corolla strigose with adpressed hairs. Corolla curved, infundibuliform, 1½ in. long. Drupe obovate, ½ in. long.

South India, Ceylon, and Indian Archipelago. Probably in the Central Provinces. Fl. nearly throughout the year. An excellent hedge-plant.

4. PREMNA, Linn.

Shrubs or trees with opposite, undivided leaves. Flowers in a bracteate terminal trichotomous panicle or thyrsus. Calyx persistent, truncate, or with 2-5 short obtuse teeth, sometimes 2-lipped. Corolla tubular, short, limb cleft into 5 or more, commonly 4, lobes, either nearly equal, or 2-lipped, upper lip consisting of 1 (the largest and outer) lobe, sometimes emarginate or nearly bifid, lower lip 3-lobed. Stamens 4, didynamous or nearly equal; anthers rounded, inserted on the back, the cells diverging at the base. Ovary 4-celled, 1 ovule in each cell; style filiform, stigma bifid, sometimes nearly entire. Fruit a fleshy drupe with a hard, rugose or tuberculate 2-4-celled kernel. Albùmen none; radicle inferior. The leaves and twigs of most species have an unpleasant smell when bruised.

Trees or shrubs, pubescent or glabrate; stigma bifid, corolla 4-lobed.
  Flowers in trichotomous corymbose panicles.
    Leaves ovate or obovate, acute or short-acuminate; main lateral nerves 2-4 pair . . . . 1. *P. integrifolia.*
    Leaves ovate or ovate-oblong, long-acuminate; main lateral nerves 4-6 pair . . . . 2. *P. mucronata.*
  Flowers in a terminal, cylindrical thyrsus . . . . . 3. *P. interrupta.*
A tree, densely stellate-tomentose; stigma indistinctly bifid, corolla 5-lobed; calyx in fruit cup-shaped enclosing the base of drupe . . . . 4. *P. tomentosa.*
A climber; leaves glabrous, shining . . . . . . 5. *P. scandens.*
An herbaceous undershrub . . . . 6. *P. herbacea.*

1. **P. integrifolia**, Linn.; Wight Ic. t. 1469.—Syn. *P. serratifolia*, Linn.; Roxb. Fl. Ind. iii. 77; *P. spinosa*, Roxb. ib. Vern. *Bakarcha*, Garhwal; *Ganniari*, Oudh.

A large shrub or middle-sized tree; stem and older branches often armed with strong opposite spines, branchlets unarmed. Leaves pubescent when young, ovate or obovate, entire or dentate, blade 2 - 3 in., petiole ½ - 1 in. long; main lateral nerves 2 - 4 pair. Flowers greenish white, somewhat viscid, exhaling an unpleasant smell, in terminal corymbose panicles. Calyx 2-lipped or irregularly 5-toothed. Corolla twice the length of calyx, the outer lobe much larger than the others. Drupe black, globose, ⅙ in. diam.

South India, Ceylon, Bengal. (Oudh forests, Garhwal, R. Thompson and J. L. Stewart. I have not seen specimens). Indian Archipelago, China, and North Australia. The leaves are shed in Feb., and are renewed between Feb. and April, earlier in moist places, later on poor dry ground. The flowers appear soon after the leaves; they resemble Elder flowers. Attains 30 ft. with stiff branches. Stem 5 ft. girth, with spines and excrescences. Often a shrub only. Bark cinereous. Branchlets fœtid when bruised. Wood white, moderately close-grained, no heartwood. The fresh-felled wood frequently exudes a green-coloured sap.

Closely allied, and perhaps not specifically distinct, is *P. latifolia*, Roxb. Fl. Ind. iii. 76; Wight Ic. t. 869, from South India, said to have been found in Kamaon.

2. **P. mucronata**, Roxb. Fl. Ind. iii. 80.—Vern. *Bankhar*, *gīan*, Pb.; *Bakar*, *bakarcha*, *basota* (*bās*, smell), *āgniūn* (*āg*, fire), *tumari*, *jhatela*, N.W.P.

A small tree, extremities and under side of leaves pubescent or soft tomentose. Leaves ovate or ovate-oblong, long-acuminate, base rounded or cordate, entire or irregularly dentate; main lateral nerves 4 - 6, on either side of midrib; blade 3 - 6, petiole 1 in. long. Flowers in terminal corymbose trichotomous panicles. Calyx with 4 or 5 rounded, nearly equal teeth. Corolla-lobes equal or bilabiate, upper lip retuse or emarginate, lower lip of 3 equal lobes, throat closed with white hairs. Drupe globose, $\frac{1}{6}$ in. diam.

Sub-Himalayan tract and outer ranges, extending north-west as far as the Chenab, and ascending to 3500 ft. Oudh forests, Sikkim, Bhutan, Silhet. The leaves are shed Jan., Feb. Fl. April-June. Attains 25 ft., trunk short, erect, 3 ft. girth, branches divergent, twigs pubescent. Bark light- dark- or reddish-grey, even, with longitudinal wrinkles. Wood hard, a good fuel, used for lighting fires by friction.

Closely allied, and perhaps not specifically distinct, is *P. barbata*, Wall.—Vern. *Ganhūla*, Pb.; *Lammar*, N.W.P. Outer Himalaya from the Jhelam to Assam, ascending to 5500 ft., said to differ by a 4-cleft calyx and a less conspicuous beard in the throat of the corolla. A moderate-sized tree, bark cinereous. Fl. April-June. The twigs have a strong unpleasant smell.

P. glaberrima, Wight Ic. t. 1484, from South India, and *P. micrantha*, Schauer, DC. Prodr. xi. 635, are also closely allied to *P. mucronata*. *P. cordifolia*, Roxb. Fl. Ind. iii. 78; Wight Ic. t. 1483, a shrub from South and Western India, resembles it in the shape of the leaves, but differs by a truncate or bilabiate calyx.

3. **P. interrupta**, Wall.; DC. Prodr. xi. 633.

A small tree, inflorescence and under side of leaves pubescent. Leaves oblanceolate or obovate, 4-8 in. long, narrowed into a short petiole, acuminate, entire, or indistinctly dentate. Flowers greenish, sessile, in compact sessile or shortly pedunculate cymose clusters supported by foliaceous lanceolate bracts, and forming a cylindrical, terminal thyrsus, often interrupted at the base. Calyx bifid. Corolla-lobes 4, nearly equal. Anthers and style exserted. Drupe globose, $\frac{1}{5}$-$\frac{1}{6}$ in. diam.

Kamaon, 6000-7000 ft. Nepal. Sikkim, 6000-8000 ft. Fl. May-Aug. A purple gum exudes from wounds in the bark. Wood 43 lb. per cub. ft., Wall.

P. racemosa, Wall.; DC. Prodr. xi. 633, Kasia, Sikkim, Nepal, is closely allied to this species.

4. **P. tomentosa**, Willd.; Roxb. Fl. Ind. iii. 76; Bedd. Fl. Sylv. t. 251.

A moderate-sized tree; branchlets, leaves, and inflorescence densely clothed with soft tawny tomentum of stellate hairs. Leaves triangular-ovate, acuminate, entire, 4-6 in. long, 3-4 in. broad, on petiole 1 in. long, Flowers pale greenish-white, shortly pedicellate, in loose terminal, rounded trichotomous panicles. Calyx truncate or indistinctly bilabiate at the time of flowering, clothed with stellate hairs. Corolla 5-lobed, the lobes nearly equal. Style exserted, minutely, and indistinctly bifid. Ovary densely tomentose. Drupe ribbed, indistinctly lobed, globose, $\frac{1}{8}$-$\frac{1}{4}$ in. diam., the lower half enclosed in the somewhat enlarged, cup-shaped, membranous calyx.

South India, Java, Ceylon, and probably in the Godavery forest of the Central Provinces. Wood yellow, hard, close-grained, takes a beautiful polish.

5. *P. scandens*, Roxb. Fl. Ind. iii. 82; Dalz. Bomb. Fl. 199, is a large climb-

ing shrub in Eastern Bengal and Western India, with glabrous, shining, ovate, long-acuminate leaves, and greenish-white flowers in a terminal corymbose panicle. 6. *P. herbacea,* Roxb. l. c. 80, is a small undershrub, common in the grass lands of the sub-Himalayan tract, from Garhwal to Assam, Oudh forests, Tirhoot. A woody perennial root produces annually, after the jungle-fires, a cluster of sessile, cuneate or obovate, pubescent leaves, edge with large triangular serratures, and a terminal, pedunculate, corymbose cyme, shorter than the leaves, with pale-yellow flowers, which open Feb.-April.

5. CALLICARPA, Linn.

Shrubs, generally clothed with soft stellate tomentum. Leaves opposite, simple. Flowers in axillary dichotomous cymes, with divaricate branches and small tomentose bracts. Calyx truncate, 4- rarely 5-dentate. Corolla-tube short, limb spreading, lobes 4, rarely 5, nearly equal. Stamens as many as corolla-lobes, exserted. Ovary 4-celled, 1 ovule in each cell; style filiform, dilated and truncate, or shortly 2-lobed. Fruit a small succulent drupe, the endocarp of 4 distinct 1-seeded pyrenes.

Clothed with dense woolly tomentum; leaves crenate .	1. *C. macrophylla.*
Hoary with short stellate hairs; leaves entire . . .	2. *C. arborea.*

1. **C. macrophylla,** Vahl; DC. Prodr. xi. 644; Roxb. Fl. Ind. i. 393.—Syn. *C. incana,* Roxb. l. c. Vern. *Pattharman, bā-pattra, baunu,* Jhelam; *Sūmāli,* Chenab; *Denthar, drūss,* Ravi; *Daya,* Kamaon; *Mathara, mattranja,* Beng.

A tall shrub, branches, petioles, and peduncles thickly clothed with tawny or grey woolly tomentum. Leaves lanceolate or oblong-lanceolate, rarely ovate-lanceolate, acuminate, crenate, 6-10 in. long, petiole ½ in., wrinkled, soft pubescent above, floccose-woolly or cottony underneath; main lateral nerves 12-15 pair. Cymes much branched, with numerous, distinct, small rose-coloured flowers, common peduncle as long as petiole. Corolla-tube barely twice the length of calyx. Stamens much exserted.

Bengal, Gorakhpur, Oudh, Rohilkhand, extending as far west as Hazara in the sub-Himalayan tract. Ascends to 6000 ft. Burma. China. Fl. May-Jan. In Hazara the heated leaves are applied to rheumatic joints.

C. tomentosa, Willd.—Syn. *Roxburghii,* Schauer; DC. Prodr. xi. 640; China, differs by long hairs intermixed with the tawny tomentum; the flowers are in compact globose hirsute heads on the ramifications of the cymes. Has not yet been found in Northern India.

C. lanata, Linn. Mant. Plant. 331; Vahl Symbolæ Bot. iii. 13—Syn. *C. Wallichiana,* Walpers; DC. Prodr. xi. 641; Wight Ic. t. 1480, of Ceylon, South and Western India, white woolly tomentose, has ovate, acuminate leaves, matted underneath with dense white tomentum, 6-12 in. long, entire or slightly crenate, petiole 1-2½ in. long; flowers pink or pale lilac, peduncle shorter than petiole, corolla more than twice the length of calyx. Will probably be found in the Centr. Prov.

2. **C. arborea,** Roxb. Fl. Ind. i. 390; DC. Prodr. xi. 641.—Syn. *C. lanata,* Hook. in Hb. Kew. Vern. *Ghiwala, dera,* Kamaon.

A tree; branches, petioles, peduncles, and under side of leaves hoary with short soft stellate hairs. Leaves ovate or ovate-lanceolate, acuminate, entire, glabrous above, blade 6-12, petiole 1-2 in. long; main lateral nerves 8-12 pair. Flowers lilac or light purple, with an unpleasant smell; cymes large, spreading, twice the length of petiole, common peduncle as long as petiole or longer.

Burma (common on deserted toungyas on the hills between Sitang and Salween). Hills of eastern Bengal, Nepal. Baraitch forests of Oudh. Kamaon, ascending to 4000 ft. A small tree in Oudh, 25 ft. high, stem 18 in. girth. Fl. May, June. Bark soft, grey. Wood whitish, hard, close-grained, polishes beautifully.

C. longifolia, Lam.—Syn. *C. lanceolaria*, Roxb. l. c. 395; East Bengal, Burma, Indian Archipelago, Queensland; pubescent, often glabrate, has serrate, lanceolate, membranous leaves, flowers in loose cymes with slender branches. Will probably be found in the Gorakhpur forests.

6. LANTANA, Linn.

1. **L. alba**, Miller.—Syn. *L. indica*, Roxb. Fl. Ind. iii. 89; Wight Ic. t. 1464. *L. collina*, Dcne. in Jacq. Voy. Bot. t. 141. *L. dubia*, Royle Ill. t. 73.

A shrub; branches 4-sided, hoary or pubescent. Leaves opposite, ovate, crenate, pubescent or hirsute, blade 1-3 in., petiole ¼ in. long. Flowers white light purple or yellow, scentless, in pedunculate axillary bracteate heads or short spikes, peduncles as long as leaf, bracts ovate, hirsute or villous. Calyx minute. Corolla-tube curved, ¼ in. long, limb oblique, spreading horizontally, divided into 4 unequal lobes. Drupe smooth, globose, dark violet, as large as a pea, enclosed by the enlarged but thin transparent calyx; nut 2-celled.

Plains of North India. Sub-Himalayan tract, ascending to 3000 ft. Sindh, Dekkan, Nilgiris, Ceylon. Fl. April-June.

7. VITEX, Linn.

Trees or shrubs. Leaves opposite, digitate, usually of 3 or 5 leaflets. Calyx 5-toothed or -lobed. Corolla-tube short, limb spreading, 5-lobed, lowest lobe larger than the others. Stamens 4, in pairs, ascending and exserted. Ovary 2- or 4-celled, 1 ovule in each cell; style filiform, shortly and acutely 2-lobed. Fruit a succulent drupe, putamen separating into 4 hard 1-seeded pyrenes.

1. **V. Negundo**, Linn.; Wight Ic. t. 519; Roxb. Fl. Ind. iii. 70.—Syn. *V. bicolor*, Willd. *V. incisa*, Lam. Vern. *Marwan, moräun, māura, mora, wana, banna, bana, torbana, biuna*, Pb.; *Shwāri, shiwāri, shawāli, mewri*, N.W.P.; *Nirgunda*, Bombay.

A small tree or large shrub; branchlets, under side of leaves or inflorescence hoary with short grey pubescence. Leaflets 3 or 5, lanceolate, shortly petiolate, entire toothed or pinnatifid, the central one 3-4 in. long, the lateral ones usually smaller; common petiole 1 in. long.

Flowers small, bluish purple, in opposite lateral cymes, forming an elongated terminal thyrsus, often compound at the base. Calyx-teeth triangular. Corolla $\frac{1}{4}$-$\frac{1}{3}$ in. long.

Common nearly everywhere in the plains and lower hills of India, westward to Peshawar and Sindh. Ascends to 5000 ft. in the North-West Himalaya. China. Fl. March-May. The branches are used for wattle-work.

V. trifolia, Linn.; Roxb. l. c. 69, is very closely allied, but is supposed to differ by shorter calyx-teeth, leaves often unifoliate, white-mealy beneath, leaflets short-petiolate, generally sessile, always entire. Bengal, South India, Burma, Indian Archipelago, Australia.

V. Agnus-castus, Linn., of South Europe and Western Asia, to Afghanistan, has flowers nearly $\frac{1}{2}$ in. long.

V. altissima, Linn.; Roxb. l. c. 71; Wight Ic. t. 1466; Bedd. Fl. Sylv. t. 252. —Vern. *Nauladi mara*, Can.; with 3- rarely 5-foliolate leaves, broadly winged petioles (on young shoots), the flowers in a terminal thyrsus, is an important timber-tree with strong wood in South India and Ceylon.

V. Leucoxylon, Linn. fil.; Roxb. l. c. 74; Wight Ic. t. 1467; with lax axillary cymes, 5-foliolate coriaceous leaves and unwinged petioles, is a large timber-tree in Burma, also found in South India and Ceylon.

8. CARYOPTERIS, Bunge.

1. **C. Wallichiana**, Schauer in DC. Prodr. xi. 625.—Syn. *Clerodendron odoratum*, D. Don. Vern. *Moni*, Kamaon.

A shrub with 4-sided glabrous branches; extremities and young leaves pubescent. Leaves opposite, lanceolate or ovate-lanceolate, acuminate, serrate; blade 2-4 in., petiole $\frac{1}{2}$ in. long. Flowers sweet-scented, in short axillary dichotomous bracteate axillary cymes, opposite or in whorls of 4-6. Calyx parted into 5 lanceolate segments with distinct middle nerves. Corolla-tube twice the length of calyx; limb bilabiate, upper lip 2-fid, lower 3-fid. Stamens 4, didynamous. Ovary 2-celled. Capsule dry, surrounded by the somewhat enlarged calyx, separating when ripe into 4 valves, each with a 1-seeded kernel attached to the inside of the valve, so that the kernels appear to have a narrow winged edge.

Outer Himalaya, from the Indus to Bhutan, ascending to 3000 ft. Salt range. Oudh forests in ravines. Fl. April; the seed ripens soon after flowering.

9. HOLMSKIOLDIA, Retz.

1. **H. sanguinea**, Retz.; Jacq. Voy. Bot. t. 140.—Syn. *Hastingia coccinea*, Kœnig; Roxb. Fl. Ind. iii. 65. Vern. *Kul tolia*, Kamaon.

A large woody climber with showy flowers. Leaves opposite, petiolate, ovate, crenate. Calyx membranous, scarlet tinged with orange, tube short, limb large, circular, 1 in. diameter, entire. Corolla tubular, curved. Stamens exserted.

Outer Himalaya. Sutlej to Assam, ascending to 3000 ft. Fl. Oct.-Dec.

10. AVICENNIA, Linn.

1. **A. officinalis**, Linn.—Syn. *A. tomentosa*, Jacq.; Wight Ic. t. 1481; Wall. Pl. As. rar. t. 271.

A small tree or large shrub, with thick fleshy branchlets and opposite coriaceous, elliptic-lanceolate leaves. Flowers yellow, sessile, in rounded heads. Calyx of 5 sepals, supported by ovate ciliate bracts. Corolla-tube short, limb of 4 nearly equal segments. Capsule compressed, ovate, mucronate, 2-valved, 1-seeded. Radicle woolly, cotyledons thick, fleshy, folded. The seed often germinates on the tree.

Salt marshes on the coasts of the peninsula, the Red Sea, Africa, Burma, Australia. Fl. April, May.

Phytolacca acinosa, Roxb.—Syn. *Rivina Latbenia*, Wall.; *Pircunia Latbenia*, Moquin, DC. Prodr. xiii. ii. 29; Vern. *Lūbar*, Hazara; *Jirka*, Bias; *Matazor*, Sutlej (Order *Phytolaccaceæ*); is a large perennial plant, not uncommon in the North-West Himalaya from Hazara to Nepal, between 3500 and 9000 ft., also in Sikkim and Bhutan, with alternate, short-petiolate, ovate-lanceolate leaves, 6-10 in. long, and greenish white pedicellate bisexual flowers in lax cylindrical racemes, with lanceolate or subulate bracts. Perianth of 5 nearly distinct segments. Stamens 8-10. Pistil of 6-8 distinct 1-ovuled carpels. Fruit dark purple and succulent, the carpels remaining distinct, forming an erect cylindrical raceme, 4-8 in. long, 1-1½ in. diameter. Fl. June; fr. Sept., Oct. In some places the leaves are eaten as a vegetable, and it is cultivated in Jaunsar (vern. *Jerunga*) and Kamaon.

Phytolacca acinosa, Roxb., has been referred by Moquin, l. c. 33, to *P. decandra*, Linn., as a variety; this, however, is a much larger plant, distinguished from *P. acinosa* by 8-10 carpels, which, when ripe, are connate into a smooth flat circular berry. Upon this character Moquin bases the generic distinction between *Phytolacca* and his new genus *Pircunia*, with 6-8 carpels, which remain distinct when ripe. Roxburgh states (Fl. Ind. ii. 458): "Berries composed of from 6-8 distinct acini," and this description is supported by the unpublished illustration in Hb. Kew, No. 1556. *P. decandra*, Linn., like most species of the genus, is indigenous in America, but has long been cultivated, and become naturalised in South Europe. In France it is called *raisin d'Amerique*, and the purple juice of the berries is used to colour wine and confectionery. It is a matter for inquiry whether *P. decandra* grows in India and whether the North-West Himalayan plant, which is found in the forest tracts of remote valleys (*e.g.*, Dippi and Kilba in Kunawar), is really indigenous in India. In North America the root of *P. decandra* is used medicinally as an emetic, purgative, and narcotic.

P. dioica, Linn. (*Pircunia dioica*, Moq.), known as *Bella Sombra*, is a fast-growing tree with thick-based trunk and soft coarse-grained fibrous wood, indigenous in La Plata and Brazil, grown (in avenues) in Spain, Gibraltar, Malta, and introduced to Bombay and Calcutta.

ORDER LXI. POLYGONEÆ.

Herbs or shrubs, rarely trees, with alternate simple stipulate leaves. Stipules usually sheathing the stem (ochreate). Flowers small hermaphrodite or unisexual. Perianth herbaceous or coloured, 3-6-lobed or 3-6-phyllous, lobes or leaves 1- or 2-seriate, equal or inner series larger.

Stamens perigynous or subhypogynous, usually 6, 9, 10, rarely more, alternate with the perianth-lobes when 1-seriate. Ovary usually free, compressed or trigonous, rarely 4-gonous, 1-celled, with a solitary erect ovule. Fruit a 1-seeded nut. Seed albuminous; albumen farinaceous. —Royle Ill. 313.

Stamens 10-20; nut setose or echinate . . . . . 1. CALLIGONUM.
Stamens 6-8; nut smooth, enclosed within the accrescent inner perianth-leaves . . . . ATRAPHAXIS (p. 373).

1. CALLIGONUM, Linn.

Nearly leafless, much-branched shrubs. Flowers hermaphrodite. Perianth 5-partite, scarcely or not at all accrescent. Stamens 10 or more. Styles 4; stigmas capitate. Nuts subtetragonous, with numerous closely forking setæ disposed in 8-16 vertical series.

1. **C. polygonoides**, Linn.; DC. Prodr. xiv. 29.—Syn. *C. comosum*, L'Heritier in Trans. Linn. Soc. i. 180. Vern. *Balanja*, *berwaja*, *tatūke*, Afg.; *Phok*, *phog*, Pb., Sindh and Shekhawatti (flowers *phogali*).

A glabrous, almost leafless shrub, with numerous branches, which are grey or reddish grey, flexuose and twisted, branchlets often fascicled, green and shining when young, internodes 1-2 in. long. Stipules short, sheathing, thinly membranous, transparent. Leaves scarce, subulate, very small. Flowers small, numerous, on filiform pedicels, in fascicles of 2-5 from the axils of the sheathing stipules. Perianth deciduous, deeply cleft into 5 thin obtuse membranous segments, red with broad white edges, the 2 outer somewhat smaller. Stamens 10, filaments dilated and pubescent at base. Nuts oblong, $\frac{1}{3}$ in. long, densely covered with long filiform, twice or thrice dichotomously branching setæ, $\frac{1}{3}$ in. long, placed in 8-16 longitudinal lines, their base thickened and confluent so as to form irregularly-shaped crests.

Common locally in the more arid parts of the Panjab plains, both cis- and trans-Indus, north as far as Lahore. Abundant west of Mozaffergarh, where it constitutes in places half the larger vegetation, the other half consisting of *Salvadora oleoides*. Sindh all along the base of the hills. One of the most abundant and characteristic plants of the Bikanir desert. North-East Afghanistan, ascending to 5000 ft. Persia, Arabia, Syria, Egypt, Algeria. Grows generally in groups or clumps, often on hummocks, generally a small shrub 3-4 ft. high, but when old, often arborescent, 12-15 ft. high, stems 2-3 ft. girth, with spreading branches. The young shoots come out about Feb., March, and the shrub is soon after covered with small pinkish flowers, filling the air with a strong pleasant odour, as of over-ripe strawberries. The fruit ripens about June. The bark of stem is whitish or reddish-grey, rough with broad, shallow furrows, inner substance red. The wood is red, with a tinge of brown, often mottled, fibrous and hard. Heartwood distinct, of darker colour. In the Panjab it is only used as fuel, but in Bikanir twigs and branches are much employed for walls and roofs of huts. Most old stems are hollow, even those under 4 in. diam. The abortive flowers, which fall in great numbers, are (in the South Panjab, and sometimes in Sindh) swept up, made into bread, or cooked with ghee, and eaten. The shoots and branchlets are eagerly browsed by goats and camels.

Atraphaxis spinosa, Linn. (*A. afghanica*, Meissner, DC. Prodr. xiv. 76), is a thorny shrub, with small thick ovate leaves, ¼-½ in. long, perianth 4-cleft to the base, the outer segments smaller, remaining unchanged, and reflexed when the seed ripens, the two inner enlarged in fruit into 2 broad-ovate, reticulate wings, ¼ in. diam., closely adpressed to, but much larger than the flat nut, which is enclosed by them. Dry stony hills in Afghanistan and Beluchistan, and throughout Western Asia.

One of the few trees belonging to this Order is *Coccoloba uvifera*, *Sea-side grape*, common on the sea-shore of the West Indies, introduced to Calcutta. Leaves broad-cordate, fruit reddish-purple, pear-shaped, sweetish, acid, in drooping racemes, consisting of the fleshy perianth, which encloses a solitary seed. Wood light, used in cabinet-work.

ORDER LXII. **LAURINEÆ.**

Trees or shrubs, more or less aromatic, with alternate exstipulate, rarely opposite, usually entire and evergreen leaves. Perianth regular, deeply 6- sometimes 4-cleft, segments equal or the outer ones smaller, imbricate in bud. Stamens normally 12, biseriate, those of the inner series opposite to those of the outer, and to the segments of the perianth, usually however half or more of the inner or outer stamens are wanting, or reduced to short staminodia. Anthers adnate, cells 2 collateral or 2 pairs superposed, each cell opening by a valve. Ovary free, 1-celled, rarely imperfectly 2-celled (adnate in Hernandia), ovules 1, rarely 2 or 3, pendulous; style simple; stigma dilated. Fruit a 1-seeded berry or drupe, often supported by the persistent perianth or base of perianth. Seed pendulous, exalbuminous; testa membranous; cotyledons thick, oily, filling the seed and enclosing the plumula and short superior radicle.—Royle Ill. 324.

Flowers usually bisexual; anthers 4-celled, those of the inner stamens extrorse.	
Berry supported by the persistent cup-shaped, truncate or dentate base of perianth	1. CINNAMOMUM.
Berry supported by the entire 6-cleft perianth, which is indurated and somewhat enlarged	2. PHŒBE.
Berry supported by the entire 6-cleft, not indurated, spreading or reflexed perianth	3. MACHILUS.
Flowers bisexual; anthers 2-celled, those of the inner stamens lateral; fruit large, base imperfectly 2-celled. . . .	4. BEILSCHMIEDIA.
Flowers dioicous; anthers 4-celled, all introrse.	
Flowers in pedunculate heads, enclosed in an involucre of 4-6 bracts; flower-heads arranged in corymbs racemes or clusters	5. TETRANTHERA.
Flowers in sessile or subsessile clusters, enclosed (in bud) by deciduous imbricate bracts	6. LITSÆA.
Flowers dioicous; anthers 2-celled, all introrse	7. DAPHNIDIUM.

Several American trees of this Order yield excellent timber. The *Greenheart* of Demerara, *Nectandra Rodiœi*, Schomb., is a splendid timber, hard heavy close-grained and exceedingly durable. It is not attacked by *Teredo navalis*. The bark (*Bebeeru* bark) is used as a febrifuge in Guiana, and has been found to contain an alkaloid (*Beberia*), which has been identified with the alkaloid in the bark of *Buxus sempervirens*, and in *Pareira Brava* (the root of *Chondodendron tomentosum*, Ruiz et Pavon, not of *Cissampelos Pareira*, as erroneously stated on p. 10. It is believed that *Beberia* is with *Quinine* an ingredient of Warburg's drops.

1. CINNAMOMUM, Burman.

Evergreen trees or shrubs, bark and leaves more or less aromatic. Leaves opposite or alternate, 3-nerved or penniveined. Flowers in axillary or terminal panicles, often unisexual. Segments of perianth 6 (sometimes more by the transformation of the outer stamens). Stamens biseriate, the outer series consisting of 6 perfect stamens, with introrse 4-celled anthers, each cell opening by a valve, the inner series of 3 perfect stamens with twin glands at their base, and extrorse sometimes 2-celled anthers, and 3 short staminodia, alternating with the stamens. Ovary free; style filiform, terminating in an obtuse, discoid, often oblique, sometimes 3-dentate stigma. Fruit a 1-seeded berry, supported and surrounded at the foot by the persistent base of the truncate or 6-toothed perianth.

Leaves opposite or subopposite, 3-nerved; persistent base of perianth 6-dentate (Section *Malabathrum*) . . .	1. *C. Tamala.*
Leaves alternate, penniveined; persistent base of perianth truncate (Section *Camphora*)	2. *C. glanduliferum.*

1. **C. Tamala,** Nees; DC. Prodr. xv. i. 17.—Syn. *C. albiflorum,* Nees; Wight Ic. t. 140. *Laurus Tamala,* Hamilton; *L.?Cassia,* Roxb. Fl. Ind. ii. 297 (not of Willd.) Vern. *Dālchīni,* Pb., N.W.P.; *Kirkiria, kikra, sinkami, silkauti,* N.W.P.

A handsome, moderate-sized tree; young twigs 4-sided, greenish grey, glabrous, smooth. Leaves subcoriaceous, opposite or subopposite, rarely alternate, elliptic-oblong, from an acute base acuminate, 3-6 in. long, glabrous, shining, the midrib dividing some distance (up to ½ in.) above the base into 3 longitudinal nerves, joined by distinct reticulate veins. Flowers whitish, numerous, in axillary and terminal pubescent panicles, pedicels as long as calyx. Calyx silky-pubescent, lobes membranous, with 3-7 distinct longitudinal nerves, ovate-oblong, obtuse, separating in a transverse line above the base, but below the middle, and falling off after flowering. Berry black when ripe, succulent, ovoid, ½ in. long, supported by the 5-lobed somewhat thickened base of the calyx.

Himalaya from 3000 to 7800 ft., common east of the Sutlej, extending sparingly to near the Indus. Kasia hills, Silhet, Tipperah, Burma, also in Queensland (Australia). Generally in shady, moist glens, not gregarious, but scattered in mixed forests. The leaves are renewed in May, and at that period the tree is conspicuous by the delicate pink colour of the young foliage. Fl. Feb., March, often on to April, May; the fruit ripens June-Oct., frequently remaining on the tree for months. Growth probably slow.

Attains 40 ft., with a straight trunk 4-5 ft. girth, bark compact, aromatic, brown or with a yellow tinge, with numerous whitish specks and blotches, wrinkled but not marked by cracks, fissures or furrows. The leaves have a fine aromatic smell and taste, stronger when dry. Wood light-brown, mottled, even-grained, with a glossy surface. The bark, especially that of the root, is used medicinally, and exported to the plains as *tajkalmi, tajkalam,* but under this name the bark of other sp. of Cinnamomum also is sold. The leaves also are medicinal, and are sold under the name of *tezpat, tajpat.*—(Pharm. Ind. 196.)

Closely allied to this species is *C. zeylanicum*, Breyn; DC. Prodr. xv. i. 13—Syn. *Laurus Cinnamomum*, Roxb. ii. 295, the true or *Ceylon Cinnamon*-tree, distinguished by thick coriaceous leaves, pale beneath, with 3 main nerves from the base, large terminal flower-panicles, and coriaceous calyx-lobes, without nerves, separating at about the middle from the lower half, which is persistent. The flowers have an unpleasant smell. The true Cinnamon is indigenous in the forests of Ceylon, ascending to 8000 ft. Cultivated in Ceylon, and in other tropical countries. According to Leschenault de la Tour, Mémoires du Muséum d'histoire naturelle, viii. (1822), 436, and notes on the subject collected during a late visit to Ceylon, which I owe to the kindness of Dr George King, the Cinnamon tree in Ceylon is generally grown in irregular coppice-woods, pure or mixed with other shrubs. Some of the stools are of great age and girth, and are said to have been planted by the Dutch when they held the island. The formation of fresh Cinnamon coppice is thus described by Leschenault de la Tour: The tree flowers more or less throughout the year, but most abundantly in Jan., Feb., and the fruit ripens from June to August. The seeds, which are oily, do not long retain their vitality; they are sown soon after ripening, either in nurseries to be transplanted in Oct. or Nov., or on the spot in plots about 1 ft. square and 6-7 ft. apart. The plants attain 7-8 ft. in 6-7 years, and those which are then fit to be peeled are cut, and the shoots which spring up are thinned out when they are 2, 3, or 4 years old, or even at an earlier age. They are not cut when less than ½ in., or more than 2½ in. diam. The whole growing crop in one plot is never cut over at once, as would, for instance, be done in a regularly managed Oak coppice-wood, but those shoots only are selected which appear fit to be used, and are in such a state as to be peeled readily. The main point attended to seems to be, to cut the shoots when quite young and tender; it is said that the bark of the older shoots yields inferior Cinnamon (G. King). The cutting is done during the rainy season, between May and October; the bark is peeled off after cutting in 3 or 4 long narrow strips from each shoot; it is then tied tightly together in parcels, and left for 24 hours. At the end of this time the epidermis and the outer bark are removed, and the inner bark, which is the aromatic and valuable part, is dried, the first day in the shade, the second day in the sun, when it gradually rolls up, forming the quills of Cinnamon, which are placed into each other and tied in bundles. The fruit of the Cinnamon tree is eaten greedily by crows, pigeons, and other birds; the seeds pass uninjured, and thus the spread and preservation of the tree is secured apart from the planted coppice-woods. Indeed, formerly almost all Cinnamon brought to market was from naturally-grown trees; and to enable their Cinnamon collectors to enter the forests beyond the limits of their own possessions, the Dutch concluded a treaty with the King of Candy: and it is said that planting was only resorted to when the supply from natural sources had become deficient.

The following species, among others, are described by Meissner in De Candolle's Prodromus as distinct; but they are so closely allied to the true Cinnamon that Thwaites, Enum. Pl. Zeyl. 253, and Bedd. Fl. Sylv. (under *Cinn. Wightii*), consider them as mere varieties: 1. *C. obtusifolium*, Nees (*Laurus obtusifolia*, Roxb. Fl. Ind. ii. 302), a large tree, as large as a Mango, with opposite, thick coriaceous, elliptic-oblong leaves (6-12 in. long), which are often in fours under the large terminal spreading panicles. Indigenous in East Bengal and Burma. 2. *C. iners*, Reinward (*L. nitida*, Roxb., *C. dubium*, Nees); Wight Ic. t. 130, 122, 122 (bis), and 135, lateral nerves and reticulation indistinct. South India, Burma, East Bengal, Nepal, and (doubtfully) Kamaon. 3. *C. Wightii* Meissner; Bedd. Fl. Sylv. t. 262. Nilgiris.

2. **C. glanduliferum**, Meissner; DC. Prodr. xv. i. 25.—Syn. *Laurus glandulifera*, Wall. Vern. *Malligiri, marisgiri*, Nepal.

A large (probably) deciduous tree; branchlets very glaucous when fresh; leaf-buds large, ovoid, covered with ovate imbricate scales. Leaves alternate, thick-coriaceous, elliptic, acuminate, penniveined, main lateral nerves 4-8 pair, narrowed into petiole ¾ in. long, blade 3-4 in. long; small glandulose pits, generally hairy, in the axils of the lateral nerves. Flowers small, yellowish-green, fragrant, in axillary grey-pubescent corymbs, several corymbs approximate near the ends of branchlets. Berry supported by the truncate base of perianth.

East Bengal (Chittagong, Silhet, Sikkim). Nepal, 6000-8000 ft. (Chandagiri, south, and Sheopore, north of the Nepal valley), Petora in Kamaon (about 5000 ft.) Fl. May, June. Attains 60-80 ft., with a straight erect trunk of 12 ft. girth and above. Foliage dense, shady. Bark 1-2 in. thick, the outside cracked and spongy; inner substance of a fine cinnamon colour, regularly striped with white lines, owing to a number of parallel layers of a white resinous substance. The smell and taste of the bark, while fresh, is extremely aromatic and pleasant, somewhat pungent, resembling that of *Sassafras;* that of the root is more powerfully scented than the bark of trunk and branches. Wood pale-yellow, very light, not strong; while fresh it has a strong smell of Camphor, like that of which the China camphor-wood trunks are made, becoming by age somewhat fainter, but more agreeable, resembling that of the bark. Grows freely at Calcutta.—Wall. in Transactions of Medical and Physical Society, vol. i., 1823, p. 5.

C. Camphora, Nees & Ebermaier; DC. Prodr. xv. i. 24—Syn. *Laurus camphorifera*, Kæmpfer′; Roxb. Fl. Ind. ii. 304, *Camphora officinarum*, Bauh.; Wight Ic. t. 1818; the *Japan Camphor-tree*, belongs to the same section, but has longer-petiolate leaves, main lateral nerves 2-3 pair, the lowest pair proceeding from near the base of the leaf. Camphor is a crystalline volatile substance, in chemical composition akin to volatile oils, which is obtained by boiling chips of the wood and roots with water, when the crude camphor is sublimed with the steam and deposited on straw, with which the head of the retort is filled. It is afterwards purified by sublimation with lime or chalk. The tree attains a considerable size, and is indigenous in China, Japan, and Cochin-China; some of the China camphor-wood trunks sold in Calcutta are made of it.

The *Sassafras tree, Sassafras officinale*, Nees; DC. Prodr. xv. i. 171, belongs to a different tribe of this Order: it is a large dioicous tree, the male flowers have 9 fertile stamens, all with introrse anthers, and without staminodia, the female flowers have 6 short sterile stamina, the leaves are obovate, with cuneate basis, often 3-lobed. Bark and wood of the root are fragrant and a valuable medicine (Pharm. Ind. 192). North America, from Canada to Florida.

2. PHŒBE, Nees.

Shrubs and trees (always ?) evergreen. Leaves alternate, penniveined. Flowers bisexual, in axillary panicles, bracts deciduous. Perianth funnel-shaped, 6-cleft. Stamens biseriate, the outer series consisting of 6 perfect stamens opposite to the segments of the perianth, with introrse, 4-celled anthers, the cells opening by valves; the inner series of 3 perfect stamens, with twin glands at their base, and extrorse anthers, alternating with 3 short staminodia. Ovary free; style filiform, stigma discoid. Fruit a 1-seeded berry, supported by the persistent, somewhat enlarged and indurated 6-cleft perianth, fruit-bearing pedicel thickened.

1. **P. lanceolata,** Nees; Wight Ic. t. 1821.—Syn. *Laurus lanceolaria,* Roxb. Fl. Ind. ii. 309; *Ocotea lanceolata,* Nees in Wall. Pl. As. rar. ii. 71. Vern. *Chan, chandra, badror, shalanghi,* Pb.; *Haulia, dandora, kāwal, sūn kauwal, bilphari,* N.W.P.

A shrub or middle-sized tree, glabrous, only youngest branchlets pubescent. Leaves alternate, often approximate and subverticillate at the base of the flower-panicles, lanceolate, 6-9 in. long, narrowed into a short petiole; main lateral nerves 6-10 pair, joined by more or less prominent reticulate veins. Flowers pale yellow, in lax pedunculate axillary panicles, often congregated in the axils of the upper leaves, pedicels a little longer than perianth. Perianth glabrous outside, the segments acute, edge finely ciliate, hairy inside. Inner series of stamens and staminodia hairy, staminodia obtusely sagittate, on a short stalk. Fruit black, succulent, oblong-ovoid, $\frac{1}{3}$ in. long.

Outer Himalayan ranges, from Bhutan to the Jumna, ascending to 6000 ft. (west to the Jhelam, not common, J.L.S.) Kasia hills, Silhet, Upper Burma (Bhamo on the Irawaddi). Fl. Feb.-June; the fruit ripens June-July.

P. pallida, Nees; DC. Prodr. xv. i. 34, a small tree with pubescent panicles and perianth, and somewhat more coriaceous leaves, is probably only a pubescent variety; I can find no other distinguishing characters. Kamaon, Nepal, ascending to 5000 ft. Moist ravines of eastern Oudh forests. Fl. June.

P. paniculata, Nees; DC. Prodr. xv. i. 37—Syn. *P. villosa,* Wight Ic. t. 1822; *Laurus villosa,* Roxb. ii. 310, (probably) with broader leaves, tomentose beneath, tomentose branchlets, petioles, and grey-hairy panicles and perianth, Nepal, Sikkim, Kasia hills, Kamaon? (Madden),* is closely allied to, if not identical with, *P. Wightii,* Meissner l. c. 38; Wight Ic. t. 1820 (*P. paniculata*), of the Nilgiris.

Similar in appearance is *Apollonias Arnotti,* Nees; Wight Ic. t. 1819; Bedd. Fl. Sylv. t. 291, with 2-celled anthers, those of the 6 outer stamens introrse, of the 3 inner ones extrorse. Berry $\frac{1}{2}$ in. long. Tinnevelly, Travancore ghats, Malabar (Beddome).

3. **MACHILUS,** Rumphius.

Evergreen trees. Leaves alternate, penniveined. Flowers bisexual, in terminal and lateral panicles. Perianth divided to the base into 6 biseriate

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* "There (towards the summit of the Kamola Ghat, above the Kotah Doon) is also a species of *Embelia,* with fruit in umbels (probably *E. robusta,* Roxb., D.B.), and a handsome shrub, *Tetranthera fruticosa,* or *apetala,* which also grows at Pūnagiri, below Gangoli, &c., and is sometimes known as the *Gar-bijaur,* or wild Citron, and *Maida* or *meda-lakri;* but the tree particularly so designated, pointed out to me near Ramesar, appeared to be *Laurus villosa,* Roxb., and its hill-name *Kapua kauwal.*"—Madden in As. Soc. Journ. xvii. i. 391. At p. 587 he mentions the same vernacular name (*Kapua kauwal*), as *L. tomentosa?* Sarda (Sarju) river at the Gangoli or Shera bridge (2500 ft. elev.)

segments, persistent, but not changed in fruit. Stamens biseriate, the outer series of 6 perfect stamens, opposite to the segments of the perianth, anthers introrse, 4-celled, the cells opening upwards by valves; the inner series of 3 perfect stamens with twin glands at their base and extrorse anthers, alternating with 3 short staminodia; stamens and staminodia of the inner opposite to the stamens of the outer series. Ovary free; style filiform, stigma discoid. Fruit a 1-seeded berry, supported by the persistent, often reflexed, segments of the perianth.

1. **M. odoratissima**, Nees.—Syn. *Laurus odoratissima*, Wall. Vern. *Dalchini*, *mith-patta* (sweet leaf), *prora*, *badror*, Pb.; *Kāwala*, N.W.P.

A middle-sized or large tree with deep-green foliage. Leaves glabrous, shining, lanceolate, 6-9 in. long, petiole ½ in. long, main lateral nerves 15-20 on either side of midrib, often alternating with shorter intermediate nerves, veins very finely and uniformly reticulate, raised so as to leave minute hollows between. Flowers pale yellow, fragrant. Perianth ¼ in. long, the inner segments a little longer than the outer ones, peduncles, pedicels and outside of perianth with soft silky hairs. Berry ovoid, ½ in. long, dark purple when ripe.

Outer Himalayan ranges, ascending to 7000 ft. in the north-west, and to 8000 ft. in Sikkim. Is found, although rare, as far north as Hazara. Kasia hills, Burma. Fl. March-Aug. The leaves have a pleasant orange-like aroma, they have frequently small rounded excrescences.

M. macrantha, Nees; Bedd. Fl. Sylv. t. 264; Wight Ic. t. 1824 (probably the same species as *M. glaucescens*, Wight Ic. t. 1825), a small tree with elliptic thick-coriaceous glaucous leaves, grows on the Western Ghats, and the Nilgiris (Dalzell Bombay Fl. 221).

Persea gratissima, Gærtn.; Wight Ic. t. 1823; Bot. Mag. t. 4580; the *Avocado* or *Alligator Pear*, is a large tree, indigenous in South America, introduced into tropical India (fr. July-Aug. in Calcutta), has paniculate greenish-white flowers, similar to those of *Machilus*, and a pear-shaped fruit 4-6 in. long, with a large seed in a soft butyraceous pulp. The perianth falls off before the fruit ripens. In the West Indies and South America the fruit is eaten raw or as a vegetable.

4. BEILSCHMIEDIA, Nees.

Trees with subopposite or alternate penniveined leaves. Flowers bisexual, in short axillary racemes. Perianth deeply 6-cleft, deciduous. Outer circle of 6 perfect stamens, opposite to the segments of the perianth, generally alternating with small glands; anthers introrse, the inner circle of 3 perfect stamens, with lateral, semi-extrorse anthers alternating with 3 short staminodia; anthers 2-celled, valves opening upwards. Ovary incompletely 2-celled, with 3 ovules; style filiform, stigma discoid. Fruit a dry oblong 1-seeded berry, base incompletely 2-celled.

1. **B. Roxburghiana**, Nees; DC. Prodr. xv. i. 63; Wight Ic. t. 1828. —Syn. *Laurus bilocularis*, Roxb. Fl. Ind. ii. 311. Vern. *Konhāiah*, Oudh.

A small evergreen tree with dark-green shady foliage. Leaves glabrous, shining, thick-coriaceous, subopposite or alternate, 4-6 in. long, elliptic-oblong, main lateral nerves 6-8 on either side of midrib, joined by prominent reticulate veins, petiole 1 in. long. Flowers whitish, in short axillary racemes, peduncles, pedicels and perianth pubescent, stamens strigose, with short white hairs, glands and staminodes yellow, thick, fleshy, stipitate. Berry 2 in. long, dark purple when ripe, with much whitish grey bloom, which rubs off easily, pulp pale yellow.

Burma, East Bengal, Nepal, Oudh forests (sparingly in moist shady ravines of the Gonda and Baraich district), Durga Deo forest in Kamaon ? leaves only, D.B. Fl. April. Attains 30 ft. and 6 ft. girth. Bark smoothish, grey or brown, peeling off in small corky scales, inner substance red, ½ in. thick. Heartwood small, dark grey, sapwood white.

B. fagifolia, Nees ; Bedd. Fl. Sylv. t. 263 ; of Canara and the Konkan, is very similar. Dalzell, Bombay Fl. 222, refers the tree of the Bombay Ghats to *B. Roxburghiana.*

5. TETRANTHERA, Jacq.

Trees or shrubs with alternate, rarely subopposite leaves. Flowers dioicous, in small umbels or clusters (flower-heads), enclosed in bud by an involucre of 4-6 large concave deciduous imbricate bracts, arranged in short racemes or clusters, axillary, or in the axils of fallen leaves. Perianth-segments usually 6, equal or nearly so, sometimes wanting. Male flowers : stamens 9-12, sometimes more, all polleniferous; filaments of the inner stamens with 2 glands at the base, anthers 4-celled, those of the inner stamens sometimes 2-celled. Female flowers : ovary free, 1-celled, 1-ovuled ; stigma dilated and lobed, staminodes sterile or wanting. Berry supported by the flattened or cup-shaped base of the perianth.

Perianth of a few hairy subulate deciduous segments, or wanting ; flower-heads in pedunculate umbels or corymbs . 1. *T. laurifolia.*
Perianth 6-cleft ; flower-heads in sessile umbels or clusters . 2. *T. monopetala.*

1. **T. laurifolia**, Jacq. ; DC. Prodr. xv. i. 178.—Syn. *T. apetala*, Roxb. Cor. Pl. t. 147 ; Fl. Ind. iii. 819 ; *T. Roxburghii*, Nees. Vern. *Maida, meda lakri,** Pb., N.W.P. ; *Gwā, riān, chandra*, Pb. ; *Gar bijaur,** *singrauf*, N.W.P. ; *Medh*, Oudh ; '*Mēnda*, C.P. ; *Ungdungnet*, Burm.

A middle-sized evergreen tree, very variable, branchlets inflorescence and leaves more or less pubescent, the older leaves often glabrate. Leaves alternate, ovate ovate-lanceolate elliptic- or obovate-oblong, pale beneath,

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* Madden (see footnote to p. 377) gives these names to *T. fruticosa*, Roxb. But this is a shrub with racemose flower-heads, probably synonymous with *T. glabrata*, Wall. (*Lepidadenia glabrata*, Wight Ic. t. 1838) ; and *T. Panamonja*, Hamilton ; Wight Ic. t. 1836 ; DC. Prodr. xv. i. 197. Roxburgh's *T. fruticosa* is from Silhet (fl. June-July) ; *L. glabrata* from the Pulneys, the Nilgiris, and Mergui (Wight) ; and *T. Panamonja* has been found in Assam, Mergui, and (according to Wight) near Courtallum.

blade 5-10 in., petiole ½-2 in. long, main lateral nerves 8-12 pair, joined by prominent reticulate veins. Flower-heads yellowish, in pedunculate umbels or corymbs, generally as long as petiole, or a little longer, partial peduncles shorter than common peduncle, flowers 8-12, rarely less, on slender pedicels; involucre of 4 rounded concave membranous bracts, ¼ in. long; involucre, pedicels and peduncles grey-tomentose with soft long hairs. Perianth-segments very irregular, generally wanting. Filaments hairy, with long soft hairs. Berry subglobose, ¼ in. diam., black and almost dry when ripe, supported by the thickened club-shaped pedicel and base of perianth.

Common in the shady parts of the Oudh forests, scarce in the Central Provinces, abundant in Kamaon and Garhwal, ascending to 4500 ft., often in Sāl forests, not uncommon in the outer Himalaya to the Ravi. Panjab Salt range, ascending to 2500 ft. South India, Ceylon, Bengal, Burma, Indian Archipelago, China, North Australia, and Queensland. Fl. June-July, the leaves are renewed April-May. Numerous forms of this extremely variable tree have been described; a marked variety from Garhwal (T. Thomson, June 1845), Patlidoon and Lalldang (April 1863, D.B.), has elliptic-lanceolate leaves, clothed with dense grey tomentum, but there are intermediate forms which undoubtedly belong to *T. laurifolia*. A similar variety has been found in Canara (Dr Ritchie, May 1853). *T. tomentosa*, Roxb.; DC. Prodr. xv. i. 177; Wight Ic. t. 1834, of South India, the leaves of which resemble this variety, has solitary flower-heads, and is quite different, though Dalzell, Bomb. Fl. 222, seems to make it synonymous with *apetala*.

Attains 40-50 ft. and a girth of 4-5 ft. Bark 1 in. thick, dark grey or brownish, somewhat excavated by the exfoliation of dark, rough scales, not marked by cracks or furrows. Inner bark brown, viscid, and glutinous. The leaves when bruised have a smell of cinnamon. Wood greyish brown, close- and even-grained, durable, not very hard, no distinct heartwood. Medullary rays fine, numerous, pores small, numerous, surrounded by patches of white tissue. The bark, of this and of the next sp., is sold and exported to the plains under the name of *Meda-lakri*, given medicinally and applied externally (bruised and mixed with goat's milk) on sprains and bruises.

2. **T. monopetala**, Roxb.—**Tab. XLV.**—Cor. Pl. t. 148; Fl. Ind. iii. 821.—Syn. *T. macrophylla*, Wall. Vern. *Meda* (*maida*) *lakri*, plains of North India; *Gwa*, Pb.; *Singraf*, *sangran*, *marda*, *kat marra*, *kakūri*, *kerauli*, *patoia*, N.W.P.; *Katmoria* (the male), *papria* (the female tree), Ganges above Hardwar (Hardwicke As. Res. vol. vi. 378); *Randkarri*, *katmēdh*, Oudh; *Mendah*, Gonds of Balaghat; *Ungdung*, Burm.

A middle-sized evergreen tree, branchlets, under side of leaves, and inflorescence with slight, often rust-coloured pubescence. Leaves alternate, elliptic-oblong, acute, blade 4-8 in., petiole ½-1 in. long, main lateral nerves 8-10 pair. Flower-heads whitish, pedunculate, in sessile or subsessile axillary clusters, peduncles shorter than petioles, flowers 5-6 on short hairy pedicels; involucre of 5 rounded concave membranous bracts, ¼ in. long. Perianth 5-6 cleft, membranous. Stamens 9-13; filaments hairy, the inner shorter with a pair of kidney-shaped glands at the base. Berry ovoid, ¼ in. long, black when ripe, supported by the spreading, somewhat enlarged base of the perianth.

Abundant in the Oudh forests, sparingly on the Satpura range, not uncommon in Kamaon and Garhwal. Siwaliks and sub-Himalayan tract west to the Ravi, ascending to 3200 ft. Salt range to 3000 ft. Extends farther north than *T. laurifolia.* Bengal, Burma (everywhere in the plains and the valleys of the principal rivers). South India, Ceylon, Indian Archipelago. Fl. March-May, the leaves are renewed about the same time; the fruit ripens June-July. Generally found in ravines on the banks of streams, or on rich deep soil.

Attains 30-40 ft., trunk short, erect, 4-6 ft. girth, generally hollow when old. Bark dark grey, smooth, but scabrous with elevated white dots, the older parts with reticulate cracks, exfoliating in corky scales. The leaves are often beset with round hollow galls or excrescences. Pith large, wood whitish, pale yellow or brown, heartwood distinct, darker coloured (R. Th.) Is used for ordinary agricultural or domestic purposes. The bark has an astringent and somewhat aromatic taste, and is used in native medicine. The leaves when bruised have a smell of cinnamon; silkworms are fed with them.

T. Doshia, Don Fl. Nep. 65.—Syn. *T. oblonga,* Wall.; *Cylicodaphne oblonga,* Meissner; DC. Prodr. xv. i. 205; *Lepidadenia Griffithii,* Wight Ic. t. 1846, is an evergreen tree with oblong-lanceolate glabrous leaves, 6-9 in. long, flower-heads on long slender pedicels in sessile or short-pedunculate axillary corymbs; berries half immersed in the cup-shaped persistent perianth. Nepal, Assam, Malay peninsula, Canara.

Dodecadenia grandiflora, Nees; DC. Prodr. xv. i. 210, is a tree with penniveined lanceolate glabrous leaves, with fine prominent reticulation, and large solitary (or twin) subsessile axillary flowers, surrounded by numerous imbricate pubescent bud-scales, berry ovoid, ½ in. long, supported by the flat, persistent base of the perianth. Kamaon, East Himalaya.

Actinodaphne is a large genus nearly allied to *Dodecadenia* and *Tetranthera.* The flowers are in lateral clusters, generally pedicellate, enclosed (in bud), by imbricate bracts. The leaves are penniveined, whorled at the ramifications and at the ends of branches, and the branchlets are mostly whorled likewise. *A. Hookeri,* Meissner; Bedd. Fl. Sylv. t. 296—Syn. *A. lanceolata,* Dalz. Bombay Fl. 312, is a large shrub, with ovate or ovate-lanceolate leaves, glabrous, dark green and shining above, glaucous beneath, young shoots and petioles rusty-tomentose, common along the Western Ghats of Canara and Sattara, and particularly abundant in the Mahableshwar forest, also found by Beddome in the North Arcot and Cadapah forests. *A. angustifolia,* Nees; Wight Ic. t. 1841, similar in habit to the preceding, but the leaves rusty-tomentose beneath. Courtallum, Nilgiris, East Bengal, Burma, where it is common in the evergreen forest-patches of the Pegu Yomah and other hills (*Shwoaygjo* and *Nalingjo,* Burm.)

6. **LITSÆA,** Juss.

Trees or shrubs with alternate leaves, often whorled and crowded at the ends of branches, usually penniveined; main lateral nerves not numerous, and the lowest pair often proceeding from near the base and more prominent, so as to make the leaves appear triplinerved. Flowers dioicous, pedicellate, in sessile or nearly sessile lateral clusters, surrounded by deciduous bracts which are imbricate in bud. Perianth-segments usually 4. Stamens of the male flower usually 4 in the outer, and 2 in the inner circle, all perfect, anthers 4-celled, introrse, the lower pair of anther-cells often lateral; a pair of glands at the base of each of the two inner stamens; no staminodes. (Sometimes 3 stamens in the inner circle, 2 of which have single glands only.) No stamens in the female flower. Berry supported by the persistent base of perianth.

Leaves often whorled, 6-12 in. long, triplinerved . . 1. *L. lanuginosa.*
Leaves alternate, 4-6 in. long, penniveined . . . 2. *L. zeylanica.*

1. **L. lanuginosa,** Nees; DC. Prodr. xv. i. 221.—Syn. *Tetranthera lanuginosa,* Wall. Vern. *Kālban,* Pb.; *Kokra,* N.W.P.

A middle-sized, evergreen tree, with large leaf-buds, enclosed by imbricate, soft-pubescent scales. Leaves often glabrous, coriaceous, lanceolate, acuminate, 6-12 in. long, narrowed into petiole 1 in. long, midrib divided some distance (½ in.) above the base into 3 main nerves, the middle nerve penniveined in the upper half of the leaf. Flowers on hairy pedicels ¼ in. long, in dense sessile lateral clusters. Perianth campanulate, villous outside; segments ovate, acute. Glands of interior anthers stipitate. Berry oblong, acute at both ends, ½ in. long.

Outer Himalaya, Kamaon, Nepal, Sikkim, ascending to 6000 ft., very sparingly north to the Indus (J.L.S.) Fl. June.

2. **L. zeylanica,** Nees; Benth. Fl. Austr. v. 307; Wight Ic. t. 132, t. 1844.—Syn. *L. consimilis,* Nees; DC. Prodr. xv. i. 223; also *L. foliosa,* Nees, and *L. umbrosa,* Nees. Vern. *Chīrndi, shalanglu, rauli, chilotu, charkha,* Pb.; *Kanwal(a), titbora, sara, jhatela, chīrara, chīrchīra,* N.W.P.

A middle-sized evergreen tree, glabrous, only leaf-buds and pedicels pubescent. Leaves alternate, thinly coriaceous, pale beneath, 4-6 in. long, on petiole ½ in. long, lanceolate, penniveined, but the lowest pair often more prominent than the others. Flowers yellowish-white, pedicellate, in dense sessile lateral 6-12-flowered clusters. Perianth funnel-shaped, segments oblong, obtuse, ciliate, pedicels and outside of perianth pubescent, rarely glabrous. Glands of interior anthers sessile. Berry subglobose, ⅓ in. diam., on slender pedicels ½ in. long. I follow Bentham in identifying the North Indian form with the tropical, *L. zeylanica* and *foliosa.* The only difference that I can trace is, that *L. consimilis* has always penniveined leaves, hairy pedicels, obtuse perianth-segments, and subglobose berries on slender pedicels; whereas in the tropical form the leaves are generally triplinerved, the pedicels are sometimes glabrous, the perianth-segments often acute, and the fruit is occasionally ovoid on thick pedicels. Farther examination of the trees on the spot is needed to decide whether there are two or several species, and how they should be defined. Roxburgh's *Laurus involucrata* (top of the mountains, Coromandel coast), Cor. Pl. t. 187, is doubtless intended for this plant, but the figure and the description have clusters of 4-5 flowers only.

L. consimilis grows in the Himalaya, generally in shady forests between 2000 and 8000 ft. from the Chenab to Nepal, inland as far as Serahn and Poinda in Bussahir (Sept. 1864, D.B.) Fl. March-May; fr. Sept.-Oct. Attains 20-25 ft., and a girth of 3-4 ft. Oil is extracted from the fruit, which is used for burning.

L. zeylanica grows in Ceylon (to 6000 ft.), on the Western Ghats, the Nilgiris, and other mountains of South India, in Hong Kong, and in Queensland. *L. foliosa* and *umbrosa*, which I cannot distinguish from *L. zeylanica*, grow in East Bengal, South India, Burma, and the Malayan peninsula. Wood light reddish-brown, compact, even-grained, not heavy. *Laurus involucrata* "has much the appearance of *L. Camphora*, every part of it smells strongly of camphor, the roots and berries exceedingly so, and are very acrid, the fresh bark, well bruised and mixed with pepper, is by the hill people employed to cure wounds. The leaves are triplinerved, and when they first appear, they are covered with a most beautiful soft satin-like, yellowish silver down" (Roxb. Cor. Pl. ii. p. 46).

7. DAPHNIDIUM, Nees.

Trees or shrubs with alternate palminerved or penniveined leaves. Flowers dioicous, pedicellate, in sessile or nearly sessile lateral clusters, surrounded by deciduous bracts, which are imbricate in bud. Perianth-segments usually 6. Stamens of the male flowers usually 6 in the outer, and 3 in the inner circle, all perfect; anthers 2-celled, introrse, a pair of glands at the base of each of the 3 inner stamens, no staminodes. Berry supported by the persistent base of perianth.

Leaves glabrous, with 3 main nerves from the base .	1. *D. pulcherrimum*.
Leaves tomentose beneath, penniveined	2. *D. bifarium*.

1. **D. pulcherrimum**, Nees; DC. Prodr. xv. i. 229.—Syn. *Tetranthera pulcherrima*, Wall. Vern. *Dadia*, N.W.P.

An evergreen tree, wholly glabrous, except the inflorescence. Leaves thinly coriaceous, pale beneath, lanceolate, long-acuminate, apex linear, 1 in. long, with 3 prominent main basal nerves, blade 4-6 in., petiole ½ in. long. Flowers yellow, on short pedicels, numerous, in axillary sessile clusters, perianth and pedicels hairy. Berry ovoid, ⅓ in. long, on pedicels ½ in. long.

Kamaon, Nepal, Sikkim, between 4000 and 9000 ft. Kasia hills. Fl. March, April; fr. June-July.

2. **D. bifarium**, Nees; l. c. 231.—Syn. *Tetranthera bifaria*, Wall.

An evergreen shrub or tree; buds, under side of leaves and inflorescence rusty-tomentose. Leaves coriaceous, glabrous and shining above, rusty-tomentose beneath, elliptic-oblong, 2-4 in. long, penniveined, petioles short. Flowers on short hairy pedicels, numerous, in axillary sessile clusters. Berries subglobose, ⅛ in. diam., supported by the flat, broad persistent base of the perianth, on short stalks.

Kamaon, ascending to 5000 ft. Nepal, East Bengal. Hong Kong. Fl. March.

Closely allied to *Daphnidium* are: 1. *Aperula Neesiana*, Blume; DC. Prodr. xv. i. 241, a tree with ovate or ovate-lanceolate leaves, perianth 4-6-fid, with very aromatic berries as large as a pepper-corn. Nepal, Sikkim, to 8000 ft., Burma, on the higher mountains between the Sitang and Salween, and the Thoungyeen and Houndrow rivers. In Burma it is called *Karawayben.* 2. *Laurus nobilis,* Linn.—*Sweet Bay* or *Laurel*—*Ghar,* Arab., well known on account of its aromatic leaves, is a small slow-growing evergreen tree, indigenous in the Mediterranean region. Hardy in England. Differs from *Daphnidium* by a 4-cleft perianth and 12 fertile stamens. A greenish coloured fat is expressed from the seeds.

ORDER LXIII. THYMELACEÆ.

Shrubs small trees or wiry herbs with tenacious bark, and alternate or opposite, entire, exstipulate leaves. Flowers usually bisexual, regular. Perianth gamophyllous, hypocrateriform or funnel-shaped; lobes 4-5 imbricate; throat with or without scales. Stamens usually as many or twice as many as perianth-segments, inserted in the throat or tube. Ovary free, 1-celled (in Thymelaceæ proper), with a solitary pendulous ovule; style simple or 0, stigma capitate. Fruit indehiscent, a nut or drupaceous. Seed usually exalbuminous; embryo straight with a superior radicle.—Royle Ill. 321.

Leaves evergreen, coriaceous; perianth not splitting laterally	1. DAPHNE.
Leaves deciduous, submembranous; perianth splitting laterally as the fruit enlarges	2. WIKSTRŒMIA.

1. DAPHNE, Linn.

Shrubs with alternate, mostly evergreen leaves. Flowers bisexual, generally in terminal heads. Perianth coloured, tubular or funnel-shaped, limb of 4 equal spreading segments, without scales. Anthers on short filaments inserted in two rows of 4 each, those of the upper series opposite to the perianth-segments, those of the lower alternate with them. Stigma capitate, subsessile. Fruit fleshy or coriaceous, remaining enclosed until near maturity in the inflated perianth-tube. Testa thick, crustaceous.

Flower-heads without bracts; leaves 1-2 in. long . .	1. *D. mucronata.*
Flower-heads with numerous bracts; leaves 3-5 in. long .	2. *D. papyracea.*

D. Laureola, Linn.; Hook. Stud. Fl. 322—*Spurge Laurel*—with poisonous berries, West Europe, North Africa, West Asia, has greenish flowers in short lateral racemes. *D. Mezereum,* Linn.; Hook. Stud. Fl. 322, is deciduous, the pink flowers in lateral clusters before the leaves. North-East Europe. Siberia. The bark is used as a vesicant.

1. **D. mucronata,** Royle Ill. t. 81.—Vern. *Laghūne,* Afg.; *Kūtūlāl, kanthan, gāndalūn, gandlena, channi niggi, shalangri, zhīkak, zosho, shīng, mashūr, swāna, jīkri, dona, kāgsari, sind, kānsian, kānsai, sonāi,* Pb.; *Pech,* Sindh.

A tall shrub, branchlets and young leaves soft-pubescent. Leaves coriaceous, lanceolate oblanceolate or linear-lanceolate, 1-2 in. long, subsessile, midrib prominent, terminating in a short sharp mucro with indistinct reticulate veins. Flowers white, with a pink tinge, slightly scented, subsessile, in terminal heads of 3-9 fl., without bracts, or with a few small early deciduous bracts. Perianth-tube ⅜ in. long, outside densely grey-tomentose, segments acute, ovate or lanceolate, half or three-fourths of the length of tube, tube glabrous inside and marked with 8 longitudinal nerves, 4 terminating in the tips of segments. Stamens inserted on the longitudinal nerves, those of the lower series in the upper half of the tube. Fruit when ripe orange or scarlet.

Eastern flanks of Suliman range between 3000 and 7000 ft. Common in the Himalaya between 2300 and 9000 ft. Also found in the inner more arid valleys of the North-West Himalaya. Fl. Sept., Oct.; fr. May, June ("blooms May-July, at times Oct., the fruit usually ripening June-Oct."—Stewart). The inflorescence is sometimes abnormally enlarged and transformed into angular subglobose lumps. Attains 7-8 ft., bark shining, dark grey or reddish brown, rugose and irregularly undulate. Wood white, mottled with wavy lines, soft, used in Chamba to make charcoal for gunpowder. Bark and leaves are used in native medicine, the berries are eaten, but are said to cause nausea and vomiting. On the Sutlej a spirit is distilled from them.

D. Cachemireana, Meisner in DC. Prodr. xiv. 535, from the Pirpanjal, is described with wholly glabrous leaves and axillary short-pedunculate flower-heads. I have not seen specimens corresponding to the description.

D. acuminata, Boiss. et Hohenacker; DC. Prodr. 536, from Kurdistan, Persia, Afghanistan, Beluchistan, has longer pedunculate flowers and short obtuse segments of perianth. There are, however, specimens from Afghanistan intermediate between this species and *D. mucronata*, and the question arises whether these species should not be united.

D. oleoides, Schreber; as described by Meisner in DC. Prodr. xiv. 533, is closely allied to the Himalayan plant, which he partly refers to it. All Himalayan specimens, however, both from the inner and outer ranges, belong to one species. Dr Stewart proposed to unite under *D. oleoides* the Himalayan, West Asiatic, and Mediterranean forms, including *D. acuminata, buxifolia, collina*, and *sericea*, and this view will probably be confirmed by farther researches of botanists who may be fortunate enough to study these shrubs in the Mediterranean region, Western Asia, and India. At present it seems preferable briefly to state the slight and variable characters by which these European and West Asiatic forms are supposed to be distinguished:—

1. *D. oleoides*, var. *brachyloba*, Meisner, a small depressed shrub. Leaves crowded at the ends of branches, glabrate, acute. Heads of 2-6 white fl., tinged with pink. Segments of perianth ovate, acute, shorter than half the tube. Fl. May, June. Western Asia.

2. *D. oleoides*, var. *jasminea*, Meisner—Syn. *D. jasminea*, Sibth. Fl. Græca, t. 358; *D. glandulosa*, Reichenb. Fl. Germ. t. 553. Same as preceding, but segments of perianth acute, lanceolate, nearly as long as or longer than half the tube. South Europe.

3. *D. buxifolia*, Vahl; DC. Prodr. 534. Leaves pubescent, segments of perianth subobtuse, shorter than half the tube. Western Asia.

4. *D. collina*, Smith; Sibth. Fl. Græca, t. 359; Reichenb. Fl. Germ. t. 554. Leaves hairy beneath. Fl. large, pink or purple, segments of perianth ovate, obtuse. South Europe, Asia Minor. Hardy in England.

5. *D. sericea*, Vahl; DC. Prodr. xiv. 535. Leaves oblanceolate, obtuse, pubescent beneath, flowers numerous in bracteate heads, segments of perianth obtuse, shorter than one-third the tube. Greece, Western Asia.

2. **D. papyracea**, Wall.; Jacq. Voy. Bot. t. 148.—Syn. *D. cannabina*, Wall.; *D. odora*, Don Prodr. Fl. Nep. 68 (not Thunb.) Vern. *Niggi, mahadeo ka phūl* (God's Flower), Pb.; *Set barūwa, satpūra*, N.W.P.

A tall shrub, branches often bi- and tri-furcate, youngest branchlets slightly pubescent. Leaves subcoriaceous, approximate near ends of branches, glabrous, lanceolate, 3-5 in. long, narrowed into a short, marginate petiole, midrib prominent, lateral nerves numerous, indistinct. Flowers scented, white yellowish or purple, sessile, in terminal heads of 6-12 fl., surrounded by numerous oblong or lanceolate bracts. Perianth-tube ½ in. long, pubescent outside, segments ovate, acute, less than half the length of tube. Stamens of the lower series inserted in the middle of the tube. Fruit ovoid, succulent, red or orange when ripe.

Himalaya between 3000 and 9000 ft., from near the Indus to Bhutan. Kasia hills. Fl. March-April, also in autumn. Attains 7-8 ft., bark ash-coloured, smooth, smells unpleasantly when bruised. In Nepal and Kamaon, paper is made of the inner fibrous bark, which is boiled with wood-ashes, washed, and beaten to pulp on a stone, and spread on frames made of bamboo matting. Daphne paper is very strong and tough, does not crack or break, very durable, is not eaten by insects, and used for important records. There is a tradition in Nepal that the art of making paper was introduced from China about 500-600 years ago. Indian Daphne paper much resembles some kinds of Chinese paper. The flowers are offered up in Hindu temples.

D. odora, Thunb.; Japan, is similar, but has more coriaceous leaves and a glabrous perianth.

2. WIKSTRŒMIA, Endl.

Trees or shrubs with opposite or alternate, submembranous, deciduous leaves. Style terminal, short; stigma capitate. Berry at first included in the perianth, which splits open laterally, and ultimately falls off.

1. **W. virgata**, Meisner; DC. Prodr. xiv. 547.—Syn. *W. canescens*, Meisner; *W. salicifolia*, Dne. in Jacq. Voy. Bot. t. 149; *Daphne sericea*, Don Prodr. Fl. Nep. 69; *D. canescens*, Wall.; *D. virgata*, Wall. Vern. *Bhat niggi, thilāk*, Pb.; *Chamlia*, Kamaon.

A small shrub, with slender branches, pubescent with long soft hairs. Leaves subopposite and alternate, lanceolate-oblong, about 2 in. long, on short petioles. Flowers white, subsessile, in many-flowered heads or spikes, which are arranged in terminal panicles. Perianth-tube slender, pubescent outside with soft silky hairs, many times longer than the ovate-oblong, obtuse segments. Ovary hairy.

Himalaya, in the Panjab to near the Indus, between 5000-7000 ft. Common in Kamaon and Nepal. Kasia hills, Ceylon. Fl. June-Aug. Paper (inferior) and rope are made from the bark in Kamaon.

Edgeworthia Gardneri, Meisner—Syn. *Daphne Gardneri*, Wall., is a large shrub with herbaceous lanceolate leaves, and large, dense, subglobose flower-heads, 1¼ in. diam. Ovary with a dense tuft of stiff hairs, style long, filiform. Nepal, Sikkim.

Lagetta lintearia, Lamarck; Bot. Mag. t. 4502, the *Jamaica Lace-Bark*, is a middle-sized tree, with ovate leaves and white flowers in loose terminal spikes. The inner bark consists of numerous distinct (annual) layers of finely reticulate fibre, made into ropes, whips, paper, lace, and all kinds of wearing apparel.

Under this Order is generally classed *Aquilaria Agallocha*, Roxb. Fl. Ind. ii. 422, and Trans. Linn. Soc. xxi. 199; Hook. Ic. t. 6; Royle Ill. p. 171, t. 36, a large tree, with alternate leaves and decandrous, bisexual flowers, the stamens alternating with short scales placed in the mouth of the perianth, which yields a great portion of the famous *Aloes* or *Eagle-wood*, used as incense and to make ornaments and rosary beads. Mountains east of Bengal.

ORDER LXIV. ELÆAGNEÆ.

Trees or shrubs, more or less lepidote, with alternate exstipulate entire leaves. Flowers usually hermaphrodite, or unisexual in *Hippophaë*, regular. Perianth inferior, gamophyllous, tubular, with a 4-lobed limb, valvate in æstivation, or dimorphic in *Hippophaë* (of male fl. diphyllous, of female fl. tubular). Stamens usually 4, epiphyllous, alternate with the perianth-lobes; 4, with subsessile anthers, between the 2 perianth leaves in *Hippophaë*. Ovary free, 1-celled, with a solitary erect ovule, closely invested by the persistent accrescent base of the perianth-tube; style simple, laterally stigmatose. Fruit indehiscent, enclosed within the at length succulent perianth-base; albumen thin; radicle inferior.—Royle Ill. 322.

Flowers unisexual, dioicous; perianth of male fl. 2-leaved .	1. HIPPOPHAË.
Flowers bisexual; perianth tubular, 4-cleft	2. ELÆAGNUS.

1. HIPPOPHAË, Linn.

Shrubs or small trees, often spinescent, with alternate narrow leaves and precocious flowers. Male flowers sessile, in the axil of deciduous bracts. Perianth of 2 opposite round or oblong leaves. Stamens 4. Female flowers axillary, solitary, pedicellate. Perianth tubular, minutely bifid at the mouth.

Under side of leaves white, velvety, with a dense tomentum of short stellate hairs	1. *H. salicifolia.*
Under side of leaves densely clothed with white or rust-coloured stellate scales	2. *H. rhamnoides.*

1. **H. salicifolia**, Don Prodr. Fl. Nep. 68.—Syn. *H. conferta*, Wall. Vern. *Ashūk*, Nepal; *Sūrch*, Bassahir.

A large shrub, with scattered lateral thorns, the ends of main branches often thorny. Leaves membranous, 2-3 in. long, linear-lanceolate, narrowed into a short petiole, edges revolute, green and glabrate above (pubescent while young), white velvety beneath, with dense soft tomentum of short stellate hairs; branchlets, petiole and midrib clothed beneath with circular, irregularly indented rust-coloured scales, a few ferruginous scales occasionally on the under side of leaves. Fruit fleshy; seed dark brown, shining, compressed, ovate or obovate, $\frac{1}{6}$ in. long, with a deep longitudinal furrow on one and a shallow furrow on the other face.

Outer and middle Himalaya. Sutlej valley up to Chini. Baspa valley (Shoang, Sangla). 5000 to 10,000 ft. Kamaon, Nepal, Sikkim (7000-10,000 ft.) Probably also on the Bias river, and in the lower Chenab and Jhelam valley. Fl. June, July; fr. Sept., Oct. Attains 20 ft. Hardy in England.

2. **H. rhamnoides**, Linn.; Hook. Stud. Fl. 323.—Syn. *H. tibetana*, Schlechtendal in Linnæa, xxxii. 296. Vern. *Tsarapp*, *tsarma*, *tsarmang*, *sirma*, *tsūk*, *tarru*, *nīechak*, *tserkar*, Ladak, Piti, and Lahoul. Regarding the following names it is uncertain whether they relate to this or to the preceding species: *Kula bīs*, *bāntphūnt*, *amb*, *kanda*, *mūlech*, Pb.; *Dhūr chūk*, *tārwā*, *chuk*, *chuma*, N.W.P.

A large thorny shrub, sometimes a small tree. Leaves subcoriaceous, ½-2 in. long, linear-lanceolate or oblanceolate, narrowed into short petiole, edges flat or revolute, branchlets and under side of leaves densely clothed with silvery or rust-coloured circular, irregularly indented scales, but not pubescent; upper side of leaves with a few scales when young, glabrous and dull green afterwards. Fruit fleshy, orange or bright scarlet when ripe, seed dark brown, nearly black, shining, obovoid, slightly compressed, less than ⅙ in. long, with a deep longitudinal furrow on one and a slightly depressed line on the other side. The specimens from the inner Himalaya, Tibet, Afghanistan, and Central Asia are silvery, whereas the European shrub has often ferruginous, mixed with silvery scales, and this character does not furnish any distinction between *H. tibetana* and *rhamnoides*. In the seeds I can discover no difference.

Afghanistan. Inner arid tract of the N.W. Himalaya, chiefly in the moist gravelly stream-beds (Lahoul, Ladak, Piti, upper Kunawar, inner Kamaon, Tibet), between 7000 and 12,000 ft., found as high as 15,000 ft. at Darma Yankti in Tibet (R. Strachey and Winterbottom). Beyond India, in Central Asia, and in Europe, where it is abundant in the shingly and gravelly valleys of the Alps and Apennines, along the Rhine (as far as Strasburg), and on other rivers descending from these mountains, and common in many places on the coast of the Mediterranean, the Atlantic, the German Ocean, and the Baltic. Cultivated for ornament in Europe, and (as a fruit-tree) at Kabul. Fl. and fr. May-Nov. The geographical limits of these two species demand farther inquiry on the spot. In the upper Sutlej valley Dr Stewart and I collected specimens (in 1864) of *H. salicifolia* as far up as Chini, and of *rhamnoides* as low down as Riba, below the mouth of the Tidong river, and the specimens collected in the arid region of the upper Sutlej, Chenab and Indus valleys, and on their tributaries, all belong to *H. rhamnoides*. Dr Stewart regarded both as one species, and it remains for future observers to determine whether there are intermediate forms, and whether (which is quite possible) *H. salicifolia* is identical with the European and Central Asiatic plant, modified by the influence of a moister climate, and less severe cold in winter. I do not attach much value to the different shapes of the seeds, discussed in detail by Schlechtendal (l. c. 295), for I find that there is considerable variation in this respect; but the stellate hairs (with 6-9 distinct arms) of *salicifolia*, are completely different from the flat circular, irregularly indented scales of *rhamnoides*, composed of numerous elongated cells radiating from a dark centre. It should, however, be borne in mind, that scales and stellate hairs differ in degree only; and it will be an interesting inquiry to trace intermediate stages, if there are any, and to indicate the connection of the structure of this fine tomentum with the difference in the climatic conditions. At present I had no alternative but to keep the two forms apart as distinct species.

Gregarious, on dry ground a low prostrate shrub, in moist places a small tree 20 ft. high, with stiff thorny branches, trunk sometimes 5-6 ft. girth, often forming dense thickets, extending continuously for miles, and nearly impervious, except along certain beaten tracts (T. Thomson, West Himalaya, 195). The roots of the European shrub are long spreading, with numerous root-shoots (drageons), and the shrub is very useful in the French Alps in fixing the loose gravel and rubble of mountain torrents and stream-beds. The bark is described by Stewart as follows—the description probably refers to the Tibetan plant: "The older bark gets reddish brown, and remains for a time pretty smooth, that of the trunk is 3 lines thick, inner substance brownish black with white dots, externally very dark, almost black-edged, white occasionally showing through long deep, very irregular, vertical and shallow short transverse furrows, which divide it into tesselated plates, the surface of which is smoothish, somewhat shining, but undulated, brownish grey, the base being brown, with white elevated specks, circular and transverse-oblong to 6 in. long. The bark has from a little distance some general resemblance to that of *Acacia modesta*." The wood of the European shrub is yellowish brown, and has distinctly-marked annual rings, the inner or spring wood of each ring being porous, and mainly composed of numerous moderate-sized vessels, the outer or autumn wood being more compact with fewer pores, medullary rays numerous, very fine. It is used for fuel and charcoal. The thorny branches are used for piled-up hedges, and the shrub is invaluable in the dry treeless tracts of the inner Himalaya. In Lahoul the thickets of *Hippophaë* are "so valued as to be considered village property" (Cleghorn, Panjab Forests, 151). The fruit is intensely acid, but boiled with sugar it forms a palatable and wholesome preserve (H.C.) In Kunawar it is made into a condiment (*Chatni*).

2. **ELÆAGNUS**, Linn.

Trees or shrubs, occasionally spinescent, with alternate entire leaves, densely lepidote at least on the under surface. Flowers hermaphrodite or unisexual by abortion, regular, pedicellate in axillary fascicles. Perianth tubular or dilatated above, with a spreading 4-valved limb, base of the tube closely constricted around the ovary; limb at length deciduous, circumsciss immediately above the ovary. Stamens 4, epiphyllous, alternate with the perianth lobes. Fruit enclosed in the succulent persistent and accrescent base of the perianth, with a bony or coriaceous kernel.

Kernel thick, osseous; a deciduous tree	1. *E. hortensis.*
Kernel thin, coriaceous, inside clothed with a dense felt of white hairs.	
Free part of perianth campanulate, not more than twice the length of segments; fruit 1-1½ in. long; an evergreen shrub	2. *E. latifolia.*
Free part of perianth tubular, more than twice the length of segments; fruit ¼ in. long; a deciduous shrub . .	3. *E. umbellata.*

1. **E. hortensis**, M. Bieberstein.—Syn. *E. angustifolia* and *E. orientalis*, Linn. (partly); Sibth. Fl. Græca, t. 152; Reichenb. Ic. Fl. Germ. t. 549; Bot. Reg. t. 1156. *E. Moorcroftii*, Wall. Pers. *Zin zeid.* Vern. *Sanjīt*, *sanjata*, Afg.; *Sirsing*, *sirshing*, Tibet; *Shiūlik*, N.W.P.

A middle-sized tree with silvery grey foliage and branchlets; branches shining, reddish-brown. Leaves ovate- or oblong-lanceolate, obtuse, blade 1-3 in., petiole ¼ in. long, under side, as well as petioles and branchlets, covered continuously by silvery circular scales, composed of radiating cells, upper side dull green with copious scattered scales, midrib prominent beneath, main lateral nerves 4-6 pair, indistinct. Flowers yellow, fragrant, axillary, pedicellate, 1-3 together. Perianth silvery outside, glabrous and yellow inside, the upper free portion campanulate, 4-dentate. Fruit axillary, solitary, ovoid-oblong, red when ripe, ¾ in., stalk ⅙ in. long, kernel oblong, with a thick osseous shell. Seed oily.

Indigenous in Central Asia, Syria, Macedonia and Greece. Cultivated in the Mediterranean region, Afghanistan, Beluchistan, Yarkand, and in Tibet, between 7000 and 10,600 ft. (Baltis, near Leh, Nubra). Thomson, l. c. 243, describes the *Elæagnus* (and Apricot) growing in places in Baltistan where "no cultivation could ever have existed," but adds that "they were too few in number to be really regarded as indigenous." Is this tree ever cultivated in the Panjab Himalaya under the name of *Ghewāin ?* Fl. (in Tibet) May-July; fr. Aug. The tree is deciduous, but the withered leaves remain attached to the tree instead of falling off at the end of autumn. Attains 25 ft., with an erect, straight trunk, 5-6 ft. girth, and a rounded, close handsome crown. Bark thick, fibrous, smooth, light grey, between deep longitudinal, ragged, dark-brown furrows. Sapwood narrow, heartwood dark brown, porous and soft, medullary rays numerous, used for fuel. A transparent brown and white gum, similar to gum-arabic, exudes from wounds in the bark (Beluchistan, Stocks). The tree is mainly cultivated on account of its fruit, which is acid (sweetish acid and mealy when ripe in Greece) and eatable. A spirit is distilled from it in Yarkand, and Moorcroft states that the annual yield of a tree is often 16-20 lb. of dried fruit. Hardy in England.

2. **E. latifolia,** Linn.—**Tab. XLVI.**—Wight Ic. t. 1856.—Syn. *E. conferta,* Roxb. Fl. Ind. i. 440. *E. ferruginea,* A. Rich.; DC. Prodr. xiv. 610. Vern. *Ghiwāi, mijhaula,* Kamaon.

Evergreen, with divergent axillary spines; branchlets, petioles and under side of leaves densely clothed with silvery or ferruginous, circular, lobed and dentate scales. Leaves ovate-oblong, acuminate, blade 5-6 in., petiole ⅓ in. long, upper surface glabrous, shining. Flowers few or numerous, pale yellow, scented, pedicellate, in axillary, often shortly pedunculate clusters. Perianth clothed outside with silvery scales, the upper free part (in the bisexual flowers) campanulate, not more than twice the length of segments. Fruit ovoid-oblong, 1-1½ in. long, red or yellow when ripe, succulent, putamen coriaceous, with 8 prominent ribs, clothed inside with a thick felt-like coating of white silky hairs.

Himalaya, Kamaon to Bhutan. (Panjab 1500 to 9000 ft., according to Dr Stewart.) Kasia hills, Silhet, Burma, South India, Ceylon, Indian Archipelago. Fl. (usually) Nov.-Feb.; fr. May, June, often remaining long on the tree. A tall straggling or more or less scandent shrub, or a small tree. The wood resembles that of *E. hortensis.* The fruit has an agreeable acid taste, somewhat astringent, and is eaten.

Roxburgh, l. c. 441, describes *E. arborea* (with white flowers, Ill. in Herb. Kew, 2432) as a large tree, a native of the Garrow hills, fruit shaped like an olive, but much larger. Is this a distinct species ?

3. **E. umbellata,** Thunberg.—Syn. *E. parvifolia,* Wall.; Royle Ill. t.

81, fig. 1; Bot. Reg. xxix. t. 51. Vern. *Ghīwāin, kankol, kankoli*, Pb., N.W.P.; *Giwāin, gawāi, gāhīn, ghīn, gīhen, giānhān, kīāin, banmewa*, Pb. (Dr Stewart gives these names to *E. latifolia*, which is not, as far as I am aware, a native of the Panjab.)

A deciduous shrub, often thorny, the current year's shoots and under side of leaves silvery grey with shining white scales, branches dull greyish-brown. Leaves oblong-lanceolate, obtuse, blade 1-2½ in., petiole ¼ in. long, under side densely clothed with silvery scales, upper side bright green, with a few scattered stellate hairs. Flowers white, axillary, often 2 or 3 together, appearing with the leaves on the current year's shoots. Perianth silvery outside, white or pale yellow inside, the upper free portion slender, tubular or elongate-conical, the 4 teeth less than half the length of (the free) tube. Fruit ovoid or globose, ⅓ in. long, succulent, putamen ribbed, coriaceous, clothed inside with a dense felt of soft white hairs.

Himalaya from near the Indus to Bhutan, between 3000 and 10,000 ft. China. Japan. Hardy in England. Fl. April-June. The fruit is eaten.

I follow Maximowicz, Diagn. Plant. Nov. Jap. Dec. viii. 560, in uniting *E. umbellata* and *parvifolia*, and in distinguishing them from *E. latifolia*, with which they are united by Thwaites, Enum. Pl. Zeyl. 252. Dr Stewart considered that both *E. latifolia*, the flowers (*gūl sanjad, dākū phal*) sold in the Panjab drug-shops, and *parvifolia* were found in the Panjab, but the latter, with white, exquisitely Heliotrope-like scented flowers, much less common.

ORDER LXV. LORANTHACEÆ.

Evergreen parasitic shrubs, living on stems, branches or roots of other shrubs or trees. A few species apparently terrestrial, are probably root-parasites. Leaves coriaceous, entire, usually opposite, often wanting. Flowers small and inconspicuous or larger and gaily coloured, regular, hermaphrodite or unisexual. Perianth in *Viscum* and *Arceuthobium* simple, epigynous, with 2-4 valvate lobes, in *Loranthus* apparently double, the outer (calyx) adnate to the ovary with a free truncate or toothed limb (probably an annular dilatation of the axis), the inner (corolla) of 3-6 free or equally or unequally cohering segments (petals), valvate in æstivation. Stamens as many as perianth-lobes or petals, opposite and adnate to them. Ovary inferior with a solitary erect ovule adnate nearly throughout to the wall of the ovary, which thus presents a homogeneous mass on section. Fruit more or less baccate, often with a strongly viscous mesocarp. Seed solitary, albuminous, in *Viscum* occasionally polyembryonous.—Royle Ill. 235; Wight Ill. ii. 63; Oliver on Loranthaceæ in Linn. Soc. Journ. vii. 90.

Flowers unisexual, dioicous or monoicous; perianth coriaceous or fleshy, inconspicuous.
  Joints not sheathing; anthers with many cells, dehiscing by numerous pores . . . . 1. VISCUM.
  Joints terminating in a cup-shaped sheath; anthers 1-celled, dehiscing by a transverse slit . . . . . . 2. ARCEUTHOBIUM.
Flowers bisexual, showy; petals 5-6, long, linear, free or connate 3. LORANTHUS.

1. VISCUM, Linn.

Glabrous shrubs with trichotomous or dichotomous branches. Leaves opposite or wanting. Flowers minute, dioicous or monoicous. Male fl.: perianth 3-4-fid, anthers adnate to the perianth-lobes, multilocellate, dehiscing by pores on the inner face. Female fl.: perianth 3-4-lobed, lobes deciduous or persistent. Style short or 0.

Leaves flat, conspicuous; perianth-segments deciduous.
  Flowers dioicous; berries white . . . . 1. *V. album.*
  Flowers monoicous; berries dark-coloured.
    Berry ovoid-oblong, smooth; leaves falcate or obliquely ovate, acute . . . . 2. *V. monoicum.*
    Berry subglobose, warty or with minute elevated dots; leaves obovate, obtuse . . . . 3. *V. orientale.*
Leaves wanting; branches flat, jointed.
  Joints cuneate; berries minute; perianth-segments persistent . . . . 4. *V. articulatum.*
  Joints linear; berries ¼ in. diam.; perianth-segments deciduous . . . . 5. *V. attenuatum.*

1. **V. album**, Linn.; Hook. Stud. Fl. 324.—Syn. *V. stellatum*, Don Fl. Nep. 142 (probably). *Mistletoe.* Vern. *Tūrapāni*, Afg.; *Bhangra, bāndu, bambal, kakbang, ahalu, wahul, rene, reori, reng*, Pb.; *Bān, bānda*, N.W.P.

A rounded, very ramous, yellowish-green shrub, about 2-3 ft. diam., wholly glabrous. Stems terete, branches jointed, dichotomous. Leaves flat, cuneate-oblong or oblanceolate, apex rounded, about 2 in. long, with 3-5 indistinct longitudinal nerves. Flowers dioicous, sessile, in clusters of 3 or 5, in the bifurcations of branches, enclosed in fleshy, slightly ciliate concave bracts, the terminal flower solitary in a cup-shaped bract, the lateral flowers in pairs (at right angles in the case of 5 fl.), each pair included in an elongated concave bract, with rounded edges. Perianth-segments triangular, acute, thick, deciduous. Berry white, smooth, almost transparent, subglobose, ¼ in. diam.

Afghanistan. Trans-Indus on the eastern slopes of the Suliman range at 3000-4000 ft. N.W. Himalaya from the Indus to Nepal, between 3500 and 9000 ft. Europe, Syria, Caucasus, Siberia, Amurland, Japan. Fl. March-May; fr. Sept.-Nov., often remaining long on the tree. The *Mistletoe* lives on most trees (rare on *Oak*, and never on the Horse- and Sweet Chestnut) in Europe. In the N.W. Himalaya it is chiefly found on the *Apricot, Peach, Pyrus variolosa, Cratægus Pyracantha*, the *Walnut, Elm, Alnus, Populus nigra*, less often on *Pavia*, the *Pear, Olea cuspidata, Morus serrata, Salix, Quercus Ilex* (Afghanistan and Suliman range), and has once been found on Oak in the N.W. Himalaya. In Lahoul it is used medicinally, and in Europe bird-lime is made of the viscid pulp of the fruit.

When the seed of the Mistletoe germinates, the roots penetrate the bark to the surface of the wood, where they spread and are gradually enclosed by the new layers of wood, and thus it comes to pass that the roots of Viscum (and Loranthus) get embedded in the wood of the foster-plant. The tissue of parasite and foster plants, however, remains always distinct. Branches infested with these parasites swell out irregularly, are often twisted and deformed, and eventually perish. The tissue of the parasite-roots is softer than the surrounding wood of the foster-plant, and decays readily. This explains the curiously grooved cavities or cup-shaped hollows in the wood of trees which have been attacked by Loranthus. Some species of *Viscum* throw out superficial roots from their stem, which attach themselves to the bark of the foster-plant by suckers. Regarding the anatomy of the Mistletoe, and the alterations which the wood-tissue of the Maple and other trees undergoes when attacked by it, see Harley on the Parasitism of the Mistletoe (Trans. Linn. Soc. xxiv. 175).

2. **V. monoicum**, Roxb. Fl. Ind. iii. 763.—Syn. *V. bengalense*, Roxb. Ill. in Herb. Kew, t. 1181; *V. falcatum*, Wall.

Stems terete, branches jointed, trichotomous, or dichotomous by the abortion of the central or one of the side shoots. Leaves bright green, flat, falcate or obliquely ovate, acute, narrowed into a short petiole, 2-4 in. long, with 3-5 prominent longitudinal nerves, edge slightly undulate. Flowers monoicous (sometimes dioicous?), short-pedicellate, in axillary pedunculate clusters of 3-5 flowers, supported by a common transversely oblong concave bract, with acute cusps. Berry smooth, oblong, blackish-brown when ripe, ¼ in. long, on a short stalk.

This species is with certainty known only from the Sundarbans (Roxburgh), Silhet, the Kasia hills (to 3000 ft.), the Sikkim Terai and lower hills (to 4000 ft.), and Gorakhpur. Oudh forests (on *Elæodendron Roxburghii*), according to sp. collected by R. Thompson and identified by Dr Stewart, which, however, I have not seen. There are also specimens in Herb. Kew collected by Edgeworth in Banda, on *Zizyphus xylopyra* and *Bassia latifolia*, which probably belong to this species. Fl. May; fr. Aug., Sept.

3. **V. orientale**, Willd.; W. & A. Prodr. 379; Benth. Fl. Hongkong. 141; Blume, Fl. Javæ (Loranthææ), tab. 24, 25.—Syn. *V. verticillatum*, Roxb. Fl. Ind. iii. 764 (not Linn.)

Stems terete, branches jointed, trichotomous or by abortion dichotomous. Leaves flat, thick, fleshy-coriaceous, obovate, obtuse, 1-2 in. long, with 3-5 indistinct longitudinal nerves. Flowers monoicous, short-pedicellate, in axillary short-pedunculate or sessile clusters of 3-5 flowers, often several clusters in one axil, each cluster supported by a common, transversely oblong concave bract. Berry globose or subglobose, ¼ in. diam., with numerous minute prominent dots, and often with larger warts.

Behar, South India, Ceylon, Indian Archipelago, Hong Kong. Fl. March-June. The characters, geographic distribution, and foster-plants of this and the preceding species demand farther inquiry, and particularly better examination of the growing plants; they seem to be very closely allied.

4. **V. articulatum**, Burm.; Benth. Fl. Hongkong. 141.—Syn. *V. moniliforme*, Blume, l. c. t. 25 B; W. & A. Prodr. 380; Wight Ic. t. 1018, 1019. Vern. *Pand.*

A small leafless parasite, with numerous slender branches, forming tufts from a few inches to 2 ft. in length. Stems terete, branches fleshy, trichotomous, flat, jointed, joints ¼-½ in. long, linear-cuneate, from a narrow base widening upwards, not striate, but often with a prominent middle line. Flowers monoicous (sometimes dioicous, var. *coralloides*, R. Wight), sessile and clustered at the end of joints; segments of perianth minute, triangular, persistent. Berry globose, very small, crowned by the persistent segments of perianth, 3-4 in sessile clusters.

Himalaya from Hazara to Kamaon 4000-9000 ft. Kasia hills, mountains of South India and Ceylon. Mt. Ophir, Malacca, Java, China and Japan, Queensland and New South Wales. Fl. May-July; fr. Oct.-Nov. Grows on a great variety of trees; in the N.W. Himalaya on *Quercus Ilex* (Jani and Kunāi in Kunawar), *incana, annulata, dilatata* (Jaunsar), on *Rhus, Olea, Rhododendron arboreum*, and the *Apricot* tree; in the Nilgiris on *Eurya;* in Japan on *Symplocos* and *Litsæa.*

5. **V. attenuatum**, DC.; W. & A. Prodr. 380.—Syn. *V. dichotomum*, Don Fl. Nep. 142 (probably). Vern. *Bŭdu, pand*, Pb., N.W.P.; *Patha*, Banda; *Bānda*, C.P.

Stems terete, branches flat, jointed, di- or tri-chotomous, forming loose tufts up to 3 ft. long; joints 1-2 in. long, striated with 6-12 prominent ribs, tapering towards the base, generally linear, less than ¼ in. wide, but sometimes oblong or ovate-oblong. Flowers monoicous, sessile, in sessile clusters of 3 at the ends of joints, each flower supported by a rounded, often ciliate concave bract. Perianth-segments thick, triangular, deciduous. Berry subglobose, ⅛ in. diam., yellow when ripe. I retain the name accepted by Wight & Arnott, but believe that farther researches will identify the plant with *V. compressum*, Poiret, Encycl. Méth. Suppl. ii. 861 (1811); Blume, l. c. t. 26, in which case this name will take precedence. Miquel's identification of *V. articulatum* (*moniliforme*) with *V. compressum* (Fl. Ned. Ind. i. pt. i. 806) I fail to understand, the 2 species (as I take them) being completely different.

Sub-Himalayan tract and outer ranges from the Ravi to Assam, ascending in the Panjab to 3000, in Kamaon to 5000, in Sikkim to 6000 ft. Kasia hills. Behar, Banda, South India, Ceylon, and Java. Fl. June-Oct.

2. ARCEUTHOBIUM, M. Bieberstein.

Leafless parasitic shrubs with articulate branches. Flowers minute, dioicous. Male fl., perianth 3-5-partite. Anthers sessile, 1-celled, dehiscing by a transverse slit. Female fl., perianth 2-dentate. Stigma sessile.

1. **A. Oxycedri**, M. Bieb.; Ledebour, Fl. Ross. ii. 380.—Syn. *Viscum Oxycedri*, DC. Vern. *Shŭk, Sāi*, Lahoul.

A small parasite, with fleshy stems, dividing di- or tri-chotomously into numerous jointed branches, forming close tufts 1-5 in. long; joints (of the lower branches) about ¼ in. long, nearly four-sided, somewhat compressed, terminating in a cup-shaped sheath which encloses the base of the next joint. Flowers dioicous, sessile in fascicles of 3-5, half immersed in concave bracts. Fruit short-stalked, ovoid, mucronate, $\frac{1}{12}$ in. long, fleshy, deep green or blackish, white when dry; seed in the lower half, cylindrical, thrown out with great force when the fruit is ripe, often 2-3 ft. off, and being covered with a viscous pulp, attaches itself readily to any branch upon which it falls.

This remarkable plant grows on *Juniperus excelsa*, in Lahoul on the Upper Chenab, at 9000-11,000 ft., where it was discovered by the Rev. H. A. Jæschke of the Tibet Moravian Mission. It pushes long creeping roots between bark and wood, and thus, as well as by seed gradually overspreads the plant on which it has once taken root, often killing the branch or the entire tree. Male and female plants are found on the same foster-tree. The fruit ripens in winter, fourteen months after flowering. The same species grows on *Juniperus Oxycedri* and on *J. communis* on the Caucasus, in Armenia and Kurdistan, Dalmatia, the French Alps (Basses Alpes near Sisteron), Algeria, and (on *Pinus ponderosa* and other species) in America on the Rocky Mountains, in California and Mexico.

3. LORANTHUS, Linn.

Shrubs with opposite, rarely alternate leaves, often with stellate hairs. Flowers usually large, showy, usually hermaphrodite. Calyx adnate, limb entire or toothed. Petals 3-6, epigynous, free or equally or unequally cohering below. Stamens subequal or alternately shorter, epipetalous (rarely free); anthers variously affixed, elliptical to linear, occasionally multilocellate, dehiscing longitudinally. Ovary inferior; style elongate, stigma capitate. Fruit more or less fleshy, with a single seed.

Petals free; pedicels opposite, in the axils of deciduous bracts	1. *L. ligustrinus.*
Petals connate into a tube; pedicels generally alternate.	
Flowers tetramerous; pedicel and ovary pubescent.	
Branchlets and under side of leaves stellate-tomentose.	
Ovary turbinate; berry club-shaped.	
Leaves ovate, 5-7 in.; petiole 1 in. long	2. *L. pulverulentus.*
Leaves broad-ovate from sub-cordate base, 2-3 in.; petiole $\frac{1}{2}$ in. long	3. *L. cordifolius.*
Ovary cylindric; berry cylindric or ovoid	4. *L. vestitus.*
Branchlets and leaves glabrous; flowers red and green in lateral fasciculate umbels or corymbs	5. *L. umbellifer.*
Flowers pentamerous; pedicel and ovary glabrous	6. *L. longiflorus.*

1. **L. ligustrinus**, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 219.

A parasitic shrub or a small (apparently) terrestrial tree, probably parasitic on roots. Branches grey, young shoots and inflorescence with slight ferruginous pubescence. Leaves opposite, glabrous, coriaceous, the upper sometimes alternate, ovate-lanceolate, narrowed into a short petiole, 1-3 in. long. Flowers $\frac{1}{3}$ in. long, pale-pink outside, deep-red inside; pedicels opposite in the axils of lanceolate deciduous bracts, in axillary, often trichotomous, panicles or racemes, which are shorter than the subtending leaf; small persistent ciliate bracteoles at the base of calyx. Corolla of 4 distinct linear petals, the upper half spreading or reflexed, the lower half converging into a four-sided, slightly expanding tube. Filaments red, attached to the base of petals; anthers basifixed. Ovary rusty-tomentose, campanulate, supported by an ovate, acute, semi-amplexicaul, adpressed bracteole, and topped by the narrow, entire calyx-limb; stigma capitate. Fruit ovoid, ·½ in. long, truncate at top, brown when ripe.

Siwalik tract and outer Himalayan ranges from the Jumna to Sikkim, ascending to 4000 ft. Kasia hills. Fl. May-July. Generally parasitic, on *Albizzia Lebbek*, *Olea*, *Litsœa;* found (apparently) terrestrial by Dr Hooker in the Kasia hills.

2. **L. pulverulentus**, Wall. l. c. 221.—Vern. *Parand*, Kamaon; *Bānda*, C.P.

A stout, woody parasite; inflorescence, young shoots, and under side of young leaves with dense yellowish-white, mealy, stellate tomentum. Leaves deep-green, opposite, coriaceous, ovate, blade 5-7 in., petiole 1 in. long; 8-10 main lateral nerves on either side of midrib. Flowers pale-green, 1 in. long, thickly tomentose, on short pedicels, in lateral racemes about 2 in. long, which are often fasciculate and axillary, or in the axils of fallen leaves; bracts none, but a small persistent bracteole at the base of ovary. Corolla slender, tubular, curved; segments linear, unilateral, about one-third the length of the tube. Anthers basifixed, about as long as free portion of filaments, cells adnate to a brown linear connective. Stigma minute, capitate. Berry ⅓ in. long, club-shaped, mealy.

Kamaon, ascending to 4000 ft., Nepal, Sikkim Terai and outer hills, Bhutan, Central Provinces (on *Butea frondosa*), Konkan. Fl. Dec.-June.

3. **L. cordifolius**, Wall. l. c. 222; DC. Prodr. iv. 302.

A stout, woody parasite; branchlets, young shoots, inflorescence, and under side of leaves soft-tomentose. Leaves opposite, broad-ovate, obtuse, from a subcordate base, blade 2-3, petiole ½ in. long. Flowers 1 in. long, outside with tawny or rusty stellate tomentum, on short pedicels, in short lateral dichotomous corymbs; bracts none, but a small persistent bracteole at the base of ovary. Corolla slender, tubular, straight or slightly curved, segments 4, lanceolate, about one-third the length of tube. Anthers basifixed, longer than free portion of filament, cells adnate to a linear obtuse connective. Stigma club-shaped, with a pointed conical tip. Berry club-shaped, ⅓ in. long.

Kashmir (often abundant on dead tops of *Platanus*), Garhwal and Kamaon, ascending to 5000 ft. Hazaribagh in Behar. Fl. Nov.-Dec.

4. **L. vestitus**, Wall. l. c. 218, and Pl. As. rar. t. 230.—Vern. *Pand*, N.W.P.

A stout, woody parasite; branchlets, young shoots, inflorescence, and under side of leaves with dense ferruginous tomentum. Leaves coriaceous, opposite, ovate-oblong or -lanceolate, narrowed into a petiole ⅓ in. long;

blade 2-3 in. long, shining above, concave and densely tomentose beneath, margins recurved. Flowers ¾ in. long, tomentose, rust- and cinnamon-coloured outside, purple and smooth inside, subsessile in compact lateral clusters; bracts none, but a small persistent ovate acute bracteole at the base of ovary. Calyx indistinctly toothed. Corolla tubular, apex subglobose in bud; segments 4, thick, concave, ovate, acute, spreading, half the length of tube. Anthers basifixed, shorter than free part of filaments. Ovary cylindric, rounded at the base; stigma capitate, 3-lobed. Berry cylindric, or ovoid, ⅓ in. long.

N.W. Himalaya from the Ravi to the Sarda, ascending to 7000 ft., on *Quercus incana*, *Odina Wodier*, *Schleichera trijuga*, *Randia*. Oudh forests, Nepal, Kasia hills (on *Oaks* and *Elæagnus*). Fl. Oct.-Jan. (most part of the year, Wall.)

5. **L. umbellifer**, Schultes.—Syn. *L. umbellatus*, Wall. l. c. 222 (not Roth). Vern. *Bānda*.

Glabrous, with long verrucose branches. Leaves opposite, ovate-lanceolate, glabrous, coriaceous, blade 4-6 in., petiole ½ in. long. Flowers 1½ in. long, blood-red at base, green at top, in lateral fasciculate umbels or in short corymbs; bracts none, but small bracteoles at the base of ovary; peduncles, pedicels, ovary, and outside of corolla slightly pubescent. Calyx short, 4-dentate. Corolla tubular, slender; segments 4 linear, reflexed, quarter the length of tube. Anthers basifixed; filaments short, strap-shaped, free portion much shorter than anthers. Style angular, stigma minute, capitate.

Himalaya, Sutlej to Bhutan, between 3000 and 10,000 ft. Kasia hills. Has been found on *Rhododendron arboreum*, *Andromeda*, and *Salix babylonica*.

6. **L. longiflorus**, Desrousseaux; W. & A. Prodr. 384; Wight Ic. t. 302. —Syn. *L. bicolor*, Roxb. Cor. Pl. t. 139; Fl. Ind. i. 548. Vern. *Pand*, *amūt*, Pb.; *Bānda*, C.P.; *Patha*, Banda; *Bara manda*, Beng.

A large handsome parasite, wholly glabrous, bark grey, with numerous woody branches, large leaves, and handsome flowers. Leaves thick-coriaceous, usually opposite, extremely variable in shape, from linear (*L. falcatus*, Linn., South India, Ceylon) to oblong broad-ovate and rotundate with amplexicaul base (*L. amplexifolius*, DC., South India, Ceylon); lateral nerves usually indistinct. Flowers large, 1½-2 in. long, the lower part red, the upper green, in unilateral racemes; pedicels as long as or longer than ovary; bracts none, but a semi-amplexicaul concave bracteole at the base of ovary. Corolla tubular, curved, split half-way down between two segments, swelling from the base to within a third of the mouth, then contracting a little; segments 5, linear, reflexed to one side. Anthers basifixed, narrow-linear, equal in length to the free portion of filaments; filaments attached above the base of corolla-segments. Ovary glabrous, cylindrical or urceolate, with a rounded base, topped by the projecting, entire, or irregularly dentate calyx. Berry oblong, pulpy, crowned with the cup-shaped calyx, black, ⅓-½ in. long. A remarkable form with oblong leaves and pubescent ovary and pedicels from Western India, perhaps a distinct species. (Belgaum—Vern. *Kokam phūl ka banda*, on *Flacourtia*, *Chloroxylon*, and *Garcinia*.)

The most common of the Indian species of *Loranthus*. In the Siwalik tract and outer Himalaya it extends west to the Jhelam, ascending to 3000 and at times to 6000 ft. in the Panjab, and to 7500 ft. in Kamaon. Common in Oudh, Bengal, Central and South India, Ceylon, and Burma; also in North Australia, Queensland, and New South Wales. Grows on most trees,—in North India chiefly on *Melia*, *Bauhinia*, *Albizzia procera*, *Acacia modesta*, the *Peach* and *Pear* trees, on *Rottlera tinctoria*; in Oudh on *Buchanania*, *Bassia*, *Diospyros*; and in most parts of India it infests the *Mango* tree; the branches on which it grows swell, get disfigured, sickly, and eventually die. Fl. chiefly from Nov. to June, but in places throughout the year.

ORDER LXVI. SANTALACEÆ.

Shrubs, undershrubs, or trees, sometimes (*Thesium*) parasitic on the roots of other plants. Leaves alternate or opposite, entire, without stipules. Flowers regular, hermaphrodite or unisexual. Perianth epigynous, gamophyllous; limb 3-4-lobed; lobes valvate or subvalvate in æstivation. Stamens as many as, and opposite to perianth-lobes, epiphyllous. Ovary inferior, 1-celled, with a free central placenta, bearing 2-5 pendulous ovules. Fruit a nut or drupe, 1-seeded; seed albuminous, with a straight embryo, radicle superior.—Royle Ill. 322.

Flowers bisexual, in short axillary panicles; stamens 4-5; small trees with opposite leaves	1. SANTALUM.
Flowers male and bisexual; stamens 3; male fl. in pedunculate clusters, arranged in leafy racemes; female fl. solitary; shrubs with alternate leaves	2. OSYRIS.

1. SANTALUM, Linn.

Trees or shrubs with opposite, rarely alternate leaves. Perianth campanulate; limb usually 4-lobed. Stamens opposite to the perianth-lobes. Central placenta of the ovary filiform, ovuliferous near the base. Fruit a drupe with a pitted or roughish putamen.

1. **S. album**, Linn.; Bedd. Fl. Sylv. t. 256; Roxb. Fl. Ind. i. 442; Bot. Mag. t. 3235.—Syn. *S. myrtifolium*, Wall.; *Sirium myrtifolium*, Roxb. Cor. Pl. t. 2. *Sandalwood.* Sans. *Chandana.* Vern. *Chandan*, *chandal*, *sandal.* (*Gandha*, Can.)

A small evergreen, glabrous tree; leaves opposite, ovate or ovate-lanceolate; blade about 2 in. long, narrowed into petiole ½ in. long. Flowers deep brownish-purple or blood-red, inodorous, in axillary cymose panicles. Perianth campanulate, limb of 4 valvate triangular segments. Stamens exserted, adnate to the perianth-tube, and alternating with 4 rounded obtuse scales. Style as long as perianth. Berry black, globose, 1-seeded. (For development and fertilisation of the ovule, see Griffith on the Ovulum of *Sant. album* in Trans. Linn. Soc. xviii. 59.)

Indigenous in the drier districts of the peninsula, particularly in Mysore, extending south to the Madura district and north to Kolapur; also on the hills of the Coromandel coast. Timor and East Java. Grown in gardens in the Dekkan, Bengal, Central India, Guzerat, Rajputana, as far north as Saharanpur. Fl. March-July, also at other seasons. Attains 20 ft. and a girth of 3 ft., with slender drooping branchlets, and light foliage. Is mainly spread through the agency of birds, and springs up abundantly in hedges and in the midst of shrubs.

The sapwood is white and scentless, the heartwood yellowish-brown and strongly scented; weight 55 lb. (Fowke), 58 lb. (Skinner); value of P., 878 (Fowke), 874 (Skinner). The heartwood is used as incense and perfume, and for carving. It is an important article of trade in India, and largely exported to China and Arabia, where it is mainly used as incense. In Madras, the wood has been found admirably suited for engraving, nearly as good as boxwood, though not quite so hard. Sandalwood oil is distilled from the wood.

Plantations of Sandalwood have been established in Mysore and in the Madras Presidency. The climatic conditions under which it seems to thrive best are: a rainfall between 20 and 50 inches; and the following limits of temperature during the different seasons—cold season 70°-80°, hot season 80°-90°, rainy season 70°-80°, autumn 70°-80°. The heartwood of the tree grown in North India has a slight scent.

The export of Sandalwood from India to China is very old. Other species of *Santalum*, which likewise yield fragrant Sandalwood, grow on the islands of the Pacific. About 1778 the export of Sandalwood from the Sandwich Islands to China commenced on a large scale. An interesting sketch of the history of the Polynesian Sandalwood trade is given in Seemann's Flora Vitiensis, p. 212.

2. OSYRIS, Linn.

Trees or shrubs, with alternate or rarely opposite leaves. Flowers hermaphrodite or unisexual. Perianth of male fl. slender, of hermaphrodite fl. obconical, 3-4-lobed above. Stamens 3-4. Central placenta of ovary very short, ovuliferous at the apex. Fruit drupaceous. Seed solitary, with copious albumen.

1. **O. arborea,** Wall.—Syn. *O. Wightiana,* Wall.; Wight Ic. t. 1853 (sometimes called *O. nepalensis*). Vern. *Bakardharra, bakarja,* Kamaon (Jameson Catalogue, 200); *Popli,* Belgaum.

A twiggy glabrous shrub; branchlets 3-sided, with prominent sharp angles. Leaves coriaceous, obovate or elliptic-oblong, 1-1½ in. long, mucronate, subsessile or narrowed into a short marginate petiole; male flowers 5-10, on short pedicels, in axillary, pedunculate clusters, often arranged in racemose panicles. Bisexual flowers solitary, axillary on long slender pedicels. Drupe subglobose, glabrous, ¼ in. long, red when ripe.

Himalaya, ascending to 7000 ft., Simla, Kamaon, Nepal, Bhutan, mountains of South India, Western Ghats. Fl. Dec.-April. Specimens collected by R. Thompson in the Central Provinces (in fruit) are pubescent all over, also perianth and drupe; the leaves are smaller, elliptic-oblong,—perhaps a new species. Similarly pubescent specimens are in Herb. Kew, collected by Dr Stocks (in Sindh?)

ORDER LXVII. URTICACEÆ.

Trees shrubs or herbs with alternate, rarely opposite stipulate leaves. Flowers apetalous, dioicous or monoicous, more rarely bisexual or polygamous, inconspicuous, solitary or variously disposed. Perianth simple, 3-5-lobed or -partite, or reduced to 1 or 2 segments, in the female flower occasionally tubular and undivided, or wholly wanting. Male fl.: stamens usually as many as perianth-segments and opposite to them. Female fl.: ovary free rarely adherent, 1- rarely 2-celled; styles often 2, connate at base, usually laterally stigmatose or stigma sessile; ovule solitary, erect and orthotropous, or laterally affixed or pendulous with a superior micropyle. Fruit a nut or small drupe, in *Moreæ* and *Artocarpeæ* usually consolidated in a syncarpium, in *Ulmus* samaroid; seed with or without albumen; embryo various, radicle superior.—Royle Ill. 333, 335, 341.

This Order is here taken in a wide sense, including the following Tribes, which are commonly regarded as separate Orders:—

Urticeæ.—Fl. unisexual; stamens equal in number to perianth-lobes; filaments inflected in bud, uncoiling elastically when the fl. opens; style 1, simple—*Boehmeria, Girardinia, Urtica, Laportea, Pouzolzia, Sarcochlamys, Debregeasia, Villebrunea, Maoutia.*

Moreæ.—Fl. unisexual, usually in dense spikes or heads; stamens equal in number to perianth-lobes, filaments inflected in bud; style 1, oftener 2, connate at the base—*Plecospermum, Morus, Broussonetia, Streblus, Taxotrophis, Phyllochlamys.*

Artocarpeæ.—Fl. unisexual, in dense spikes or heads, often with fleshy axis, or enclosed in a fleshy receptacle; stamens as many as perianth-lobes or fewer, not inflected in bud; trees or shrubs with milky juice, leaves convolute in bud and amplexicaul stipules—*Ficus, Cudrania, Antiaris, Artocarpus, Castilloa, Brosimum.*

Celtideæ.—Fl. unisexual or polygamous in axillary or lateral cymes; filaments short, erect or slightly incurved in bud; styles 2, ovary 1-celled; fruit drupaceous—*Celtis, Sponia.*

Ulmaceæ.—Fl. mostly bisexual; stamens not inflected in bud; styles 2, ovary 1-2-celled; fruit dry, usually winged—*Ulmus.*

Stamens inflected in bud; style one, simple.
A shrub, armed with axillary thorns; female flowers in globose heads; perianths connate, tubular with a small 4-dentate mouth; fruit a fleshy compound berry with few large seeds . . . . 1. PLECOSPERMUM.
Trees or shrubs without thorns; female fl. in heads, spikes, or panicles; perianths not connate.
Stigma long linear; fruit dry.
Flower-heads in spikes or panicles; stigma persistent . 2. BOEHMERIA.
Flower-heads sessile, axillary; stigma articulate . 3. POUZOLZIA.
Stigma sessile, tufted; fruit of numerous small berries in globose heads . . . . 4. DEBREGEASIA.
Female perianth none; stigma penicillate; flower-heads in axillary panicles . . . . 5. MAOUTIA.

Stamens inflected in bud; styles two more or less connate at the base.	
Female fl. numerous, spicate	6. MORUS.
Female fl. solitary	7. STREBLUS.
Stamens not inflected in bud; style one.	
Flowers on the inside of a hollow, globose, or pear-shaped receptacle	8. FICUS.
Flowers on the outside of a fleshy receptacle; in globose or cylindrical heads.	
Flowers dioicous; perianths of 4, free, not connate segments or leaves	9. CUDRANIA.
Flowers monoicous; male perianth of 2-4 segments or leaves; female perianths tubular connate with each other	10. ARTOCARPUS.
Stamens not inflected in bud; styles two, more or less connate at the base.	
Flowers polygamous; ovary 1-celled; fruit fleshy.	
Perianth deciduous; stamens shorter than perianth .	11. CELTIS.
Perianth persistent; stamens longer than perianth .	12. SPONIA.
Flowers commonly bisexual; ovary 1-2-celled; fruit a winged samara	13. ULMUS.

1. PLECOSPERMUM, Trecul.

Tree or shrub with alternate entire leaves. Flowers dioicous, collected in dense globular heads. Male fl.: perianth 4-fid, segments imbricate. Stamens free; filaments inflexed in æstivation; anthers globose, 2-celled. Ovary rudimentary. Female fl.: perianth gamophyllous, with a narrow 4-dentate mouth. Ovary free, 1-celled, with a solitary pendulous ovule; style filiform, exserted; stigma papillose. Fertile nuts consolidated with the succulent perianth-segments and abortive ovaries into an irregular few-seeded berry-like syncarpium; seed exalbuminous.

1. **P. spinosum**, Trecul; DC. Prodr. xvii. 233; Wight Ic. t. 1963.—Syn. *Batis spinosa*, Roxb. Fl. Ind. iii. 762; *Trophis spinosa*, Willd. (partly).

A large shrub or small tree, armed with straight axillary spines; branchlets glabrous, only extremities and inflorescence pubescent. Leaves glabrous, short-petiolate, oval elliptic or obovate, obtuse or acute, entire, 2-3 in. long, lateral nerves and reticulate veins indistinct. Flower-heads yellowish, axillary, solitary or 2-3 together, on peduncles as long as heads, the male heads ¼ in. diam., the female heads smaller while in flower, but enlarging in fruit to about ½ in. Male fl.: perianth-segments obtuse or emarginate, hairy outside. Stamens inserted around a hairy rudimentary ovary, inflexed in bud, exserted afterwards. Perianths of female fl. connate into a pubescent globose head, the orifice of each perianth indistinctly 4-toothed, and a single filiform papillose style protruding from it. Fruit a compound irregularly-shaped 1-2-seeded berry, ½ in. diam., the other ovaries being abortive.

Nepal, Rohilkhand (Salt range, rare, on the top of mountains at 3000 ft.—J. L. S.) South India, Ceylon. Fl. Feb.-April. Bark fibrous.

2. BOEHMERIA, Jacq.

Shrubs or small trees with opposite or alternate toothed or occasionally lobed simple stipulate leaves. Flowers small dioicous or monoicous, in globose usually 1-sexual clusters. Male fl.: perianth 4- (rarely 3-) -lobed or -partite, segments valvate in æstivation. Stamens as many as perianth-segments. Pistil rudimentary. Female fl.: perianth tubular, compressed or ventricose, usually narrowed to a minutely 2-4-toothed mouth. Ovary free or adherent, 1-celled, with a solitary erect or ascending ovule; style laterally stigmatose. Nut dry. Seed with more or less albumen.

Leaves alternate; branches terete.
  Leaves broad-ovate, acuminate; petiole half the length of leaf or longer . . . . 1. *B. nivea.*
  Leaves elliptic-lanceolate; petiole many times shorter than leaf . . . . 2. *B. rugulosa.*
Leaves opposite; branches four-sided.
  Leaves broad-ovate; petiole one-fourth the length of leaf or longer . . . . 3. *B. platyphylla.*
  Leaves lanceolate; petiole many times shorter than leaf . 4. *B. macrophylla.*

1. **B. nivea**, Hook. et Arn.; DC. Prodr. xvi. i. 206; Hooker's Journal of Botany, iii. (1851) 315, t. 8.—Syn. *Urtica nivea*, Linn. *U. tenacissima*, Roxb. Fl. Ind. iii. 590; Wight Ic. t. 688. *China grass*, *Rheea.*

A shrub; young branches and shoots herbaceous, branches and petioles tomentose, with long soft hairs. Leaves alternate, broad-ovate, 3-6 in. long, acuminate, dentate with large triangular, slightly curved teeth, base truncate but tapering suddenly into petiole, the upper side of leaf pubescent and rough, the under side white, densely matted with closely adpressed hairs; basal nerves 3, all penniveined, the lateral nerves joined by prominent transverse veins; petiole half the length of leaf or longer, stipules subulate, deciduous. Flowers greenish, monoicous, in axillary panicles; panicles in pairs, shorter than petiole, bearing numerous sessile flower-heads along their entire length, female panicles in the upper, male panicles in the lower axils. Style much exserted, hairy.

Indigenous, and cultivated in China, Japan, and the Indian Archipelago. Cultivated in Assam, upper Bengal, and (within the last 20 years) in North-West India. Fl. July-Sept. The inner bark of the young shoots contains one of the finest fibres produced by the vegetable kingdom. It is soft, fine, with a beautiful silky gloss, and at the same time exceedingly strong. The exquisite textures known under the name of China grass cloth are made of it. Examined under the microscope, Rheea fibre consists of large single tubes or elementary fibres, whereas the fibre of jute, hemp, and flax, consists of bundles of tubes or elementary fibres. The elementary fibres of Rheea are much longer than those of jute, hemp, or flax. Cotton, like Rheea, consists of single tubes (hairs), but they are thinner, much shorter, and less strong. Rheea fibre is an article vastly superior to jute (the produce of *Corchorus capsularis*, p. 37). Both fibres were brought to notice in Europe about the beginning of this century, both are produced in Bengal, but the value of the jute exported from India exceeds £4,000,000 a-year, and is now inferior in value only to the exports of cotton, opium, and rice, whereas the export of Rheea is as yet insignificant. The reason of this is twofold. The preparation of jute is easy, and that of Rheea difficult; and secondly, jute thrives luxuriantly in the climate of Bengal on comparatively poor soil, whereas Rheea requires rich soil and continuous moisture. Rheea is easily propagated from cuttings, and when grown for its fibre, it resembles a perennial plant, the herbaceous shoots being cut several times a-year.

2. **B. rugulosa,** Weddell.—Syn. *Urtica rugulosa,* Wall.

A small tree with greyish-brown branches, the youngest branchlets as well as petioles and under side of leaves hoary. Leaves alternate, elliptic-lanceolate, short-petiolate, 3-5 in. long, obtusely dentate, with 3 longitudinal nerves from the base to the apex of leaf, each nerve penniveined, the lateral veins of the midrib anastomosing in a marked manner with those on the inside of the two side nerves, the lateral veins on the outside of the side nerves being joined by an intramarginal vein running close under the edge of leaf, nerves and veins prominent on the under side, impressed and (the veins) indistinct on the upper side of leaf. Flowers dioicous in round sessile clusters, each cluster in the axil of a cordate membranous bract, the clusters arranged in long undivided lateral spikes. The leaves somewhat resemble those of *Sarcochlamys pulcherrima,* with which it has sometimes been confused, but it is readily distinguished by the long simple flower-spikes.

Garhwal (Kotridun), Kamaon, Nepal, Sikkim, Bhutan. *B. nervosa* of Madden (The Terai and outer mountains of Kamaon, Journ. As. Soc. xvii. i. 587), and of Jameson (Catalogue, 1854); "Vern. *Geti, gainti;* wood excellent for making bowls, for which purpose it is extensively used in Kamaon," is probably this species.

3. **B. platyphylla,** Don Prodr. Fl. Nep. 60; DC. Prodr. xvi. i. 210.—Syn. *B. rotundifolia,* Don, ibid. *U. macrophylla,* Wall. Vern. *Gargela,* Kamaon.

A shrub with four-sided herbaceous branches; branchlets and leaves rough with scattered short adpressed hairs. Leaves broad-ovate, acuminate, dentate with large triangular teeth, basal nerves 3, all penniveined, blade 3-9, petiole 1-5 in. long. Flowers whitish, monoicous and dioicous, in long axillary interrupted spikes, generally much longer than the subtending leaf. Male spikes often branching, in monoicous plants occupying the lower axils of the leaves. Styles hairy, exserted. An extremely variable plant, of which 3 principal varieties may be noted in the North-West Himalaya. *α. macrostachya; Splitgerbera macrostachya,* Wight Ic. t. 1977, with very large long-petiolate leaves, female spikes generally undivided. *β. rotundifolia,* with rotundate abruptly acuminate leaves. *γ. scabrella; Urtica scabrella,* Roxb. Fl. Ind. iii. 581; Wight Ic. t. 691, with small leaves, flower-spikes as long as leaf or shorter.

Outer ranges of the Himalaya, ascending to 7500 ft. Parisnath in Behar. East Bengal, hills of South India and Ceylon, Indian Archipelago, Japan and China. Fl. April-Aug.

4. **B. macrophylla,** Don Prodr. Fl. Nep. 60; DC. Prodr. xvi. i. 209.—Syn. *Urtica penduliflora,* Wall.

A shrub or small tree, branchlets four-sided, and strigose with short adpressed hairs. Leaves 6-12 in. long, lanceolate, obtusely serrate, soft-pubescent beneath, upper side rough, the substance of the leaf projecting in raised angular plots between the impressed veins, basal nerves 3, the side nerves extending through three-fourths of the length of leaf, the midrib penniveined in its upper part. Stipules lanceolate, with a prominent hairy midrib, petioles strigose, 1 in. long. Flowers monoicous, in long drooping axillary simple spikes; the clusters of flowers in the axils of lanceolate bracts.

Kamaon, Nepal, Sikkim, ascending to 4000 feet. Kasia hills. Fl. Aug.-Sept.

The true nettles (*Urtica*, *Girardinia*, *Laportea*) differ from *Boehmeria* and its allies by stinging hairs and the perianth of the female flower being 2-4-cleft, not tubulose. *Girardinia heterophylla*, D$^{ne.}$ in Jacq. Voy. Bot. t. 153 —Syn. *Urtica heterophylla*, Willd. Vern. *Keri*, Jhelam; *Kīngi*, Chenab; *Ein*, *sanoli*, Ravi; *An*, *jān*, *kal*, Bias; *Kārla*, *bhābar*, Sutlej; *Awa*, *alla*, *chichru*, *bichua*, N. W. Himalaya, is a large gregarious forest weed, multiplying exceedingly on rich soil; covered all over with long stinging bristles, leaves large, dentate, pinnatifid, 3-lobed, and sometimes entire, stipules ovate, flowers dioicous, in branching, more or less glomerate, paniculate spikes, female perianth of two unequal segments, nuts flat, ovate, acute, 1-2 lines long, glabrous, shining, surrounded by a mass of bristles, with which the ramifications of the panicle are thickly set. Himalaya, 2500 to 8000 ft. Kasia hills. Fl. July, Sept. Closely allied, and perhaps not specifically distinct, are *G. palmata*, Wedd., DC. Prodr. xvi. i. 101—Syn. *G. Leschenaultiana*, D$^{ne.}$, with large cordate stipules, edge of leaves cut into long lanceolate triangular teeth—Nilgiris; and *G. zeylanica*, D$^{ne.}$; DC. Prodr. ibid.—Syn. *Urtica heterophylla*, Roxb. Fl. Ind. iii. 586, Wight Ic. t. 687; female panicles when in fruit short compact, irregularly reniform, but sometimes cylindric, stipules ovate—Burma (abundant in the forests of the Pegu Yoma, particularly in the Zamayi), Mount Aboo, Western Ghats, and the Konkan, Ceylon. The *Nilgiri nettle* includes both *G. palmata* and *G. zeylanica*. These 3 species (or varieties) yield a fine and strong fibre, which is made into twine and ropes. Coarse cloth is made of it in Sikkim.

Laportea crenulata, Gaudich.; Bedd. Fl. Sylv. t. 306—Syn. *Urtica crenulata*, Roxb. iii. 591; Wight Ic. t. 686—*Mealum-ma* of Sikkim, is a large shrub, with glossy penniveined entire or crenulate leaves, 6-18 in. long, flowers dioicous, female perianth minute, campanulate, 4-lobed; numerous minute poisonous hairs on young shoots, which make the handling and even the vicinity of the plant extremely painful, the effects lasting for days. It is a remarkable fact that the sting of this plant is poisonous only in autumn (Hook. Him. Journ. ii. 188). East Bengal, Burma, evergreen forests of the western coast; Ceylon and Java. Ropes are made of the fibre. Well known to children in Europe is the burning sting of *Urtica dioica*, Linn.; Hook. Stud. Fl. 332, a perennial herb of Europe, and the temperate regions of the northern and southern hemisphere (Kashmir and Kunawar in the N.W. Himalaya).

3. **POUZOLZIA**, Gaudichaud.

Shrubs or herbs, usually with alternate leaves. Flowers monoicous, rarely dioicous, in sessile axillary clusters or spikes, the male and female flowers usually intermixed. Male flowers: perianth 4-5-lobed or -partite, segments valvate in æstivation. Stamens 3-5. Pistil rudimentary. Female flowers: perianth tubular or ovoid, narrowed at the 2-4-toothed mouth. Ovary included, usually free, 1-celled with a solitary erect or ascending ovule; style laterally stigmatose, filiform, deciduous. Nut enclosed in the persistent, sometimes winged perianth.

1. **P. viminea**, Wedd.; DC. Prodr. xvi. i. 228.—Syn. *P. ovalis*, Miq. *P. borbonica*, Wight Ic. t. 2100.

A small shrub with slender virgate branchlets; branches, petioles and nerves on the under side of leaves, strigose. Leaves alternate, ovate-lanceolate, pale beneath, acuminate, dentate with large acute teeth, rough with numerous minute raised points, blade 3-6, petiole ½-1 in. long; basal nerves 3, extending to three-fourths the length of leaf. Flowers monoicous, in sessile axillary clusters, with numerous ovate bracts.

Kamaon, Nepal, Sikkim, ascending to 5000 ft. Bhutan, Assam, Kasia hills, Chittagong, Burma, Java. Fl. June-Sept. In Sikkim the leaves are eaten.

Sarcochlamys pulcherrima, Gaudich.—Syn. *Urtica pulcherrima*, Roxb. Fl. Ind. iii. 588, is a large shrub with beautiful, alternate, serrate, lanceolate leaves, grey beneath, shining but rough above, with 3 longitudinal nerves, joined by regularly transverse reticulate veins, blade 6-12, petiole 1-2 in. long; flowers dioicous, in short axillary recurved panicles, 2 from each axil, composed of short glomerate spikes, female perianth obliquely campanulate, the mouth lateral, 4-toothed. Assam, Silhet, Chittagong, Burma, forming in Pegu, with *Blumea grandis*, *Buddleia*, and other fast-growing large herbs and shrubs, the dense thicket which springs up on deserted Toungyas. (*Tsatyaben*, Burm.)

4. DEBREGEASIA, Gaudich.

Shrubs with rough serrate alternate leaves. Flowers monoicous or dioicous, the male clustered, the female in small heads. Male flowers: perianth 4- rarely 3-partite, segments valvate in æstivation. Stamens 4 or 3. Pistil rudimentary. Female flowers: perianth tubular, dilated below, with a narrow 4-toothed mouth, more or less adnate to the 1-celled ovary. Ovule solitary, suberect; stigma sessile, tufted. Fruit a small drupe, the outer fleshy layer resulting from change during maturation of the perianth and outer stratum of the ovary. Albumen copious.

Flower-heads in dichotomous cymes	1. *D. longifolia.*
Flower-heads sessile or subsessile	2. *D. bicolor.*

1. **D. longifolia**, Weddell in DC. Prodr. xvi. i. 235^{24}.—Syn. *Conocephalus niveus*, Wight Ic. t. 1959. *Missiessya velutina*, Wedd.

A large shrub, branchlets pubescent and often with long scattered hairs. Leaves lanceolate, serrate, upper side rough, under side grey with soft pubescence of fine adpressed hairs, penniveined, the lowest pair of lateral nerves from the base, blade 4-6, petiole 1 in. long. Flowers monoicous, in small heads, on dichotomous axillary cymes, numerous bracteoles mixed with the flowers. Male perianth longer than bracteoles. Fruit yellow, of numerous minute, pointed fleshy berries.

Kamaon, Nepal, Sikkim, ascending to 5000 ft. Kasia hills, Burma (common on deserted Toungyas), South India, Ceylon, Java. Fr. Oct.-Jan.

2. **D. bicolor**, Wedd. l. c. 235^{25}.—Syn. *D. hypoleuca*, Wedd. *Missiessya hypoleuca*, Wedd. *Urtica bicolor*, Roxb. iii. 589. *Boehmeria salicifolia*, Don Prodr. Fl. Nep. 60. Vern. *Kharwala*, *shakai*, Afg.; *Chainchar*, *chainjli*, *chenjūl*, *amrer*, *sandāri*, Jhelam; *Sansaru*, *sūss*, Chenab; *Siāru*,

sihāru, tulsiāri, east of Ravi; *Pīncho, prīn,* Upper Sutlej; *Tushiāri,* Kamaon.

A large shrub, branchlets and petioles with soft grey tomentum. Leaves lanceolate or linear-lanceolate, shortly petiolate, serrate, upper side rough with numerous minute round elevated dots, under side white, with soft densely matted tomentum, penniveined, the lowest pair of lateral nerves basal. Flowers monoicous, in round axillary sessile or subsessile heads, numerous bracteoles mixed with flowers. Male perianth outside white-tomentose, as long as bracteoles. Fruit yellow, of numerous minute pointed fleshy berries.

Afghanistan. Salt range. Common, generally in valleys near water, in the North-West Himalaya east to the Sarda river, ascending to 5000 ft., and extending up the Sutlej valley as far as Wangtu. Fl. March, April; fr. June-Aug. Twine and ropes are made of the fibre.

Villebrunea frutescens, Blume; DC. Prodr. xvi. i. 235^{21} (Syn. *Urtica frutescens,* Thunb.; Roxb. Fl. Ind. iii. 589, and *Bohmeria efrutescens,* Thunb.), is a shrub, with slender pubescent branches, ovate, acuminate, serrate leaves, concolor or white beneath, 3-nerved, the midrib penniveined in the upper half of leaf, blade 2-4, petiole 1-2 in. long. Flowers dioicous, in sessile or subsessile compact heads, lateral, below the leaves, numerous bracteoles between the flowers. Fruit of many minute dry ovoid nuts, the base surrounded by the connate, half fleshy bracteoles.—Kamaon, Vern. *Gur tushiara* (?), Madden, Nepal, Sikkim, ascending to 5000 ft., Bhutan, China, Japan.

4. **MAOUTIA,** Weddell.

Shrubs, with alternate triplinerved leaves, hoary-tomentose beneath. Flowers monoicous or dioicous, clustered or capitate, the clusters loosely and irregularly cymose, cymes usually in pairs from the axils. Male flowers: perianth 5-partite. Segments valvate in æstivation. Stamens 5. Pistil rudimentary. Female flowers: perianth usually 0. Ovary ovoid, with a solitary suberect ovule; style short; stigma sublateral persistent. Nut slightly compressed or trigonous, outer stratum slightly fleshy. Albumen thin.

1. **M. Puya,** Wedd.—Syn. *Urtica Puya,* Wall. *Boehmeria frutescens,* Don Prodr. Fl. Nep. 59. *B. Puya,* Hook. Journ. Bot. iii. (1851) t. 7. Vern. *Poi, pūa,* N.W.P. See Madden in Journ. As. Soc. xviii. i. 622.

A shrub, branches with long soft hairs. Leaves elliptic, long-acuminate, dentate with large triangular teeth, white beneath with densely matted hairs, 3 prominent basal nerves, blade 3-6, petiole 1-2 in. long, stipules axillary, deeply bifid. Flowers monoicous, in small round heads, either unisexual or composed of male and female flowers mixed, the flower-heads in axillary dichotomous panicles shorter than petioles, with slender branches. Female flowers without perianth. Nuts triquetrous.

Garhwal, Kamaon, Nepal, Sikkim, ascending to 4000 ft. Kasia hills. Burma, hills east of Toungoo above 2500 ft. (D. B.) Fl. May-July. Cloth and fishing-nets are made of the fibre. Regarding this and other Nettle-fibres, see Royle, Fibrous Plants of India.

6. **MORUS,** Linn.

Trees or shrubs with alternate, simple leaves and deciduous stipules. Flowers unisexual, monoicous or dioicous; male flowers in deciduous spikes, female flowers in spikes or heads. Perianth in male flower always deeply 4-parted, in female flower of 4, sometimes of 2 or 3 segments or distinct leaves. Stamens 4, opposite to and longer than perianth-segments, inserted around a minute rudimentary ovary, anthers 2-celled, introrse, opening longitudinally, filaments flattened at base. Ovary 1-celled or 2-celled, one cell smaller and often without an ovule, otherwise one ovule in each cell. Fruit a compound berry, consisting of the succulent perianths, enclosing each a 1-seeded carpel with a thin membranous, afterwards gelatinous pericarp. Embryo curved in a fleshy albumen.

Perianth of female flowers of 4 leaves or segments, the 2 inner flat or concave, the 2 outer more or less keeled.
  Female flower-spikes short ovoid.
    Leaves acute; styles short, free, glabrous or slightly hairy . . . . 1. *M. alba.*
    Leaves long-acuminate; styles long, hairy, connate to one-fourth their length . . . . 2. *M. indica.*
  Female flower-spikes long, cylindric . . . . . . 3. *M. lævigata.*
Perianth of female flowers of 2-4, generally 3, equal, oblong segments . . . . 4. *M. serrata.*

Bureau, in the xvii. vol. of De Candolle's Prodromus, unites all these under *M. alba,* but maintains *M. nigra* as a distinct species. The matter seems to demand farther inquiry on the spot in India.

1. **M. alba,** Linn.—**Tab. XLVII.**—Roxb. Fl. Ind. iii. 594; DC. Prodr. xvii. 238; Reichenb. Fl. Germ. t. 657.—Syn. *M. tatarica,* Linn. *Mulberry. Mûrier blanc,* Fr.; *Maulbeerbaum,* Germ.; *Moro,* It. Vern. *Tūt, tūl, tūlklu, chīnni, chūn.*

A middle-sized deciduous tree, youngest branchlets, petioles, and under side of leaves along nerves slightly pubescent. Leaves ovate, base often cordate, dentate, frequently lobed, blade 2-3 in., petiole ½-1 in. long, 3 basal nerves, middle nerve penniveined. Fl. monoicous, the sexes often on distinct branches (Willkomm). Female spikes pedunculate, peduncle as long as spike or nearly so, perianth and style glabrous or slightly ciliate. Perianth-segments of male flower elliptic. Styles distinct, varying in length. Fruit white or red, sweet.

From this species *M. nigra,* Linn.; Reichenb. Fl. Germ. t. 658—the *Black Mulberry; Gelso nero,* It.—is distinguished by tomentose broader more firm and thick leaves, often 5-nerved, short-pedunculate or subsessile female flower-spikes, perianth and styles densely hairy, and purple, acidulous and sweet fruit. Male and female fl. on distinct branches, often dioicous (Willkomm). I do not venture to decide whether *M. atropurpurea,* Roxb. l. c. 595, with long cylindric dark-purple fruit, brought to Calcutta from China, should be referred to *M. alba,* of which Bureau makes it a variety.

The Mulberry is commonly cultivated in Afghanistan, Beluchistan, abundantly in the Peshawar valley and the northern part of the trans-Indus territory. Also in the Panjab plains, in Kashmir and the North-West Himalaya, ascending in Ladak to 11,000 ft. Likewise in Europe, Western, Central Asia, and China. The home of the *Black Mulberry* is unknown; it is stated to be wild in Persia and Afghanistan (classic writers were familiar with the tree, which was early introduced to Greece, and thence to Italy). The black is a larger tree than the white Mulberry; both are hardy in England. In Eastern Europe *M. nigra* is more tender than *M. alba.* The home of the *White Mulberry* is probably China; it was not known to ancient writers, and was introduced into Europe in the fifteenth century (Hehn Kulturpflanzen, 283). In North India the tree is leafless during the cold season, the new leaves appear from the middle of February to March or even to April—there is great variation in that respect; and trees are often seen bare, while others close to them are in full leaf. Fl. March, April; the fruit ripens May, June, later of course at great elevations. Attains 30-40 ft., with an erect trunk 6-8 ft. girth (occasionally 10-12), one in the Salt range 16 ft. Bark grey or light brown, with shallow furrows. Sap white, soft, heartwood yellow, yellowish-brown or reddish-brown, with distinct annual rings, which, as in the *Ash*, are marked by an inner belt of large pores close together, forming the spring wood, the outer belt being wider, with small, scanty, but uniformly distributed pores. Medullary rays numerous, showing in a vertical section like narrow horizontal bands. Polishes well, and is a strong useful wood, much employed for building, furniture, and agricultural implements. Also used in boat-building on some of the Panjab rivers. Weight of the European wood 38-56 lb. The twigs are tough and strong, in Kashmir they are used for binding loads. The leaves are largely used as fodder, particularly for sheep and goats. In Kashmir the tree is important for feeding the silkworm, and the felling of trees even in private gardens is prohibited.

The chief product of this tree, however, in the Panjab, Beluchistan, and Afghanistan, is the fruit, of which there are many varieties, sweet and acid, and of all shades of colour, from white to a deep blackish purple. The large white kind of the Peshawar valley (*Shah tūt*) is one of the best. The following kinds are cultivated in Beluchistan, according to Stocks: *Siah*, colour black and white mixed; *Bedana* (seedless); *Pewandi* (grafted), with delicious pearly small white fruit; *Shah tūt* (Royal Mulberry); *Khar tūt* (Jackass Mulberry). It remains for farther inquiry on the spot which of these varieties should be classed under *M. alba* and *nigra*, and it is not impossible that it may, in the Panjab and Afghanistan at least, be found impracticable to maintain the distinction between the two species. In Kashmir and Afghanistan the fruit furnishes a considerable portion of the food of the inhabitants in autumn, and much of it is dried and preserved.

2. **M. indica,** Linn.; Roxb. Fl. Ind. iii. 596.—Syn. *M. parvifolia,* Royle. Sans. *Tula.* Vern. *Tūl,* Pb.; *Tūtri,* N.W.P.; *Tūt,* Bengal.

A deciduous shrub or small tree; buds, stipules, and youngest leaves with long hairs. Leaves pubescent when young, rough afterwards with minute round raised dots, ovate, long-acuminate, sharp-serrate, often deeply lobed, with 3 basal nerves, midrib penniveined, blade 2-5 in., petiole ½-1½ in. long. Male fl. short-pedicellate, perianth-segments elliptic, hairy as well as pedicel and peduncle. Female fl.: spikes short-ovoid, on slender peduncles about half the length of spike; leaves of perianth obovate, with broad white edges; styles long, hairy, connate to about one-fourth their length. Fruit small, ovoid or subglobose, black when ripe. Dr Stewart considered this as merely a variety of *M. alba.* Farther researches on the spot will perhaps confirm this view; the question is, whether the characters here stated—long-acuminated leaves, connate styles, and the shape of perianth-segments—are constant or not.

Not uncommon wild in the sub-Himalayan tract and outer hills of the Panjab and Kamaon, ascending to 5000 and occasionally to 7000 ft. Wild in the valleys of Sikkim, ascending to 4000 ft. China, Japan. This is the Mulberry which is generally cultivated as a low shrub in Bengal, Burma, and in places in the peninsula for its leaves, which are used to feed the silkworm. Fl. Feb.; fr. May. Grows sometimes into a small tree, 20-25 ft. high, with 16-18 in. girth. Bark grey. Wood hard and close-grained.

3. **M. lævigata**, Wall.—Syn. *M. glabrata*, Wall. Vern. *Tūt.*

A middle-sized or large deciduous tree; stipules and bud-scales with long soft hairs, extremities and youngest leaves slightly pubescent. Leaves glabrous, smooth or slightly rough, ovate, short-acuminate, sometimes lobed, base often cordate, blade 3-7 in., petiole about 1 in. long, basal nerves 3, midrib penniveined with 4-6 pairs of main lateral nerves. Flowers in long, drooping, short-pedunculate spikes, peduncles hairy. Male fl. sessile, perianth-segments concave, very hairy outside, filaments slightly dilated at base. Female fl.: perianth of 4 glabrous, rotundate, concave segments; styles slightly connate at base, papillose, otherwise nearly glabrous.

Wild and cultivated in the Himalaya from the Indus to Assam, ascending (in East Nepal) to 4000 ft. Burma (evergreen forests, Thoungyeen, D.B., March 1859). Cultivated (scarce) on the Soane in Behar. Fl. Nov.-March; fr. March-May. The fruit is long, cylindrical, yellowish-white, sweet but insipid.

4. **M. serrata**, Roxb. l. c. 596.—Syn. *M. pabularia*, D^{ne}. in Jacq. Voy. Bot. t. 151. Vern. *Krūn, karūn, tūt, kāura, karru, tūlūkūl, tūlklu, soā, ān, shta, chīmu, kimu*, Pb.; *Kimu, himu*, N.W.P.

A large deciduous tree with scaly buds; branchlets, petioles, and young leaves soft-pubescent or tomentose. Leaves broad-ovate, acuminate, often lobed, edge deeply cut with large acute serratures, stipules broad-lanceolate, blade 2-8 in., petiole 1-2 in. long. Flowers (dioicous, Madden) in short-pedunculate cylindrical spikes, male spikes 1-2 in., female spikes ½ in. long, peduncles soft-tomentose, with long hairs. Male fl.: perianth-segments elliptic-oblong, very hairy outside; filaments tapering from a broad flat 1-nerved base. Female fl.: perianth-segments 2-4, commonly 3, equal, ciliate, styles connate at base, very hairy. Fruit not very fleshy, mucilaginous, sweet, purple.

Common wild locally, in many parts of the N.W. Himalaya, generally from 4000 to 9000 ft., descending in places to 2500 ft. Cultiv. up to Chergaon in Kunawar. The young leaves come out in May; fl. April, May; fr. June-Aug. Attains 60-70 ft., with an erect trunk of great girth, 9-10 ft. not uncommon. Dr Stewart noted several of 20 ft., and one, a magnificent specimen, at the Hindu temple, Barmaor on the Ravi, in the Chamba State (elev. 7000 ft.), of 28 ft. girth. Growth apparently slow, annual rings distinct. Bark pale greyish-brown, with a reddish tinge, smooth or rough with irregular shallow vertical fissures, not running into each other. Sometimes the outer bark peels off in scales, somewhat similar in appearance to the bark of *Æsculus indica*. Heart-wood yellowish or dark reddish-brown, with white medullary rays. Easily worked, not heavy, polishes beautifully, and might answer for cabinet-work. Is used for agricultural implements, toys, troughs, and similar articles. The tree is often lopped for cattle-fodder.

Broussonetia papyrifera, Vent.; DC. Prodr. xvii. 224; Bot. Mag. t. 2358, the *Paper Mulberry*, is a middle-sized dioicous tree, with ovate dentate leaves, the upper side rough, the under side soft-tomentose, male flowers in cylindrical catkins, female flowers in compact, tomentose heads, from which project, at the time of maturity, long fleshy stalks, bearing 1-seeded carpels. The leaves of young trees and root-suckers are often lobed. Japan, China, Polynesia, Siam. Hardy in England, also in France and Western Germany. Wood light-coloured, even-grained, not hard and not heavy. The *Tapa*-cloth of the South Sea Islands is made of the inner bark; in Japan paper is made of it, particularly the thick paper for the eggs of the silkworm; and in Siam and Burma the thick blackened card-boards, used like slates in Europe for accounts and other writing. (*Pala-baik* Burm.) In February 1859 I found it growing apparently wild, on the Salween river (lat. 18° 40′) near Kolodo and Dahguin zeik, at the borders of the Karenee country. This useful tree seems to accommodate itself readily to different conditions of climate, and might advantageously be cultivated in North-West India.

7. STREBLUS, Loureiro.

Tree or shrub with alternate coriaceous distichous leaves and small lateral early deciduous stipules. Flowers dioicous, male in shortly pedunculate axillary clusters, female singly pedunculate. Male fl.: perianth 4-partite, segments imbricate, stamens inflexed in æstivation. Female fl.: perianth 4-phyllous, segments dry concave concealing the ovary. Ovary 1-celled with a solitary pendulous ovule, stigmas 2 filiform. Fruit globose, enclosed in the accrescent perianth. Albumen none.

1. **S. asper**, Lour.; Bedd. Fl. Sylv. Anal. gen. t. 26.— Syn. *Trophis aspera*, Retz.; Roxb. Fl. Ind. iii. 761; *Epicarpurus orientalis*, Blume; Wight Ic. t. 1961. Vern. *Jindi*, Pb.; *Sīora, sihoura, karchanna, rūsa*, Oudh, N.W.P.; *Barranki, barinika*, Tel.

A rigid shrub or a small scraggy tree with dark-green foliage, branchlets hairy, all parts full of milky juice. Leaves short-petiolate, elliptic or obovate, 2-4 in. long, penniveined, irregularly dentate, rough on both sides with minute raised round dots; stipules obliquely lanceolate. Flowers dioicous. Male fl. in short-petiolate globose heads, with a few bracteoles at the base; perianth campanulate, 4-fid, pubescent outside. Female fl. solitary, on slender peduncles, longer than flower, supported by 2 bracteoles; perianth 6-fid, closely imbricate, two opposite segments inside, two outside; styles two, long-filiform, connate at the base. Fruit a yellow 1-seeded berry, partly enclosed in the enlarged perianth.

Sub-Himalayan tract west to the Bias river. Oudh forests, Banda, Behar, Bengal, South India, Ceylon, Burma, Siam, and Indian Archipelago. Generally in dry open forests, often on poor soil. Male trees generally more abundant than female trees. The leaves are renewed in March. Fl. Jan.-March; fr. May-July. Attains 20 ft., with a short erect trunk, 3-4, rarely 6 ft. girth. Bark ½ in. thick, grey, greenish-white or brown, smooth, with faint ridges, rough when old, with small corky exfoliating scales. Inner substance milky, composed of greenish-white, reticulate, soft silky fibres. Wood white, tough and elastic, no distinct heartwood. Weight 42¾ lb. (Kyd), 45 lb. (Skinner). Value of P. 570 (Kyd), 604 (Skinner). A good hedge-plant, coppices well, and has been recommended for the production of fuel. The twigs are used as toothbrushes, and the leaves to polish wood and ivory. In Siam paper is made of the bark. The leaves are lopped extensively for fodder. The milky juice is used medicinally, the berries are greedily eaten by birds.

Phyllochlamys spinosa, Bureau in DC. Prodr. xvii. 218—Syn. *Taxotrophis Roxburghii*, Blume Mus. Bot. Lugd. Bat. ii. 78; Bedd. Fl. Sylv. Anal. gen. t. 26; *Trophis spinosa*, Roxb. l. c. 762; *Epicarpurus spinosus*, Wight Ic. t. 1962 —Vern. *Sukali*, Tel, is a small tree on the hills of the Coromandel coast and farther south in the peninsula, with straight axillary, often leaf- and flower-bearing spines, male fl. in sessile heads, female fl. solitary, short-pedunculate, perianth of 4 lanceolate tapering leaves, enlarged in fruit, and much longer than the yellow cup-shaped berry, from which the seed, enclosed in a thin endocarp, protrudes in a way similar to the seed of *Taxus*, whence the name of *Taxotrophis* (uniting the characters of *Taxus* and *Trophis*).

8. FICUS, Linn.

Trees or shrubs, juice usually milky. Leaves alternate, rarely opposite, entire or lobed; stipules amplexicaul, usually deciduous. Flowers unisexual, minute, on the inside of a hollow, globose ovoid or pear-shaped receptacle, commonly called a fig, supported at the base by 3 or 4 bracts, the mouth of the receptacle closed by numerous scales in several rows, the inner scales turned inwards, those of the outer row more or less erect. Numerous bractlets generally between the flowers. Receptacles usually androgynous, male flowers few, near the mouth, rarely numerous, mixed with the female flowers, or in separate receptacles. Perianth thin, colourless, hyaline or membranous or subcoriaceous, and then frequently red, of 3-6 segments or distinct leaves, the segments of the female perianth often narrow, and sometimes very thin or entirely wanting. Stamens 1 or 2, rarely more, and then opposite to the perianth-segments; anthers generally of two distinct cells, versatile or basifixed. Ovary 1-celled, very rarely 2-celled, style usually lateral, short or filiform; stigma terminal, peltate, or long, penicillate, or bifid. Receptacles either in the axils of leaves, generally in pairs, or clustered on leafless but often bracteate racemose or paniculate branches on the old wood. The fruit generally requires several months to ripen; it consists of the enlarged, generally fleshy receptacle, often stalked, with the bracts at the base of the stalk, enclosing numerous minute seed-like nuts, often surrounded by the persistent membranous or succulent perianth. Embryo curved in a fleshy albumen.

A large genus, comprising upwards of 600 species, of which more than 60 are Indian. *Urostigma*, *Covellia*, and other genera, established by Gasparrini and

Miquel, are now reunited with *Ficus* in the enumeration of species published by Miquel in the third volume of Annales Musei Bot. Lugduni Batavi, 1867.

- I. Receptacles axillary, usually in pairs; the ripe fruit often in the axils of fallen leaves.
  - Receptacles sessile or subsessile; leaves glabrous or hairy, never rough; male fl. monandrous; stigma elongated, feathery (subgenus *Urostigma*).
    - Main lateral nerves 4-15 pair, prominent.
      - Petioles short, less than one-fourth the length of blade.
        - Roots from branches numerous, growing into supports and secondary stems; fruit pubescent, red when ripe . . . . 1. *F. bengalensis*.
        - Roots from branches not numerous; fruit tomentose, grey when ripe . . . . 2. *F. tomentosa*.
      - Petioles one-third or one-half the length of blade.
        - Fruit sessile; main lateral nerves 8-12 pair; fruit white when ripe . . . . 3. *F. infectoria*.
        - Fruit on short peduncles; main lateral nerves 6-8 pair 4. *F. Wightiana*.
      - Petioles long, exceeding half the length of blade; fruit black when ripe.
        - Point (acumination) of leaf linear, 1-3 in. long; petiole generally as long as greatest breadth of leaf . 5. *F. religiosa*.
        - Point of leaf subulate, ½ to 1 in. long; petiole shorter than greatest breadth of leaf . . . . 6. *F. cordifolia*.
    - Main lateral nerves numerous, slender . . . . 7. *F. retusa*.
  - Receptacles pedunculate; leaves generally rough; male fl. often 2-3-androus; stigma generally bifid. (These spp. belong to various subgenera, the characters and limits of which are not yet exactly defined.)
    - Petioles between one-fourth and one-half the length of leaf.
      - Leaves generally lobed; branchlets pubescent or glabrous . . . . 8. *F. Carica*.
      - Leaves dentate, not generally lobed; branchlets tomentose . . . . 9. *F. virgata*.
    - Petioles less than one-fourth the length of leaf.
      - Leaves elliptic-oblong or ovate.
        - Leaves elliptic-oblong; main lateral nerves 7-10 pair 10. *F. parasitica*.
        - Leaves ovate; main lateral nerves 4-6 pair . . 11. *F. scandens*.
      - Leaves oblong-lanceolate, long-acuminate . . . 12. *F. trachycarpa*.
- II. Receptacles on leafless racemose or paniculate branches from the old wood, generally on the trunk; male fl. generally monandrous, perianth of 3-4 large hyaline segments, enveloping each other; female perianth none or small, or very thin and transparent (subgenus *Covellia*).
  - Leaves alternate.
    - Leaves short-petiolate, very unequal-sided, the lower lobe of the base rounded, projecting . : . 13. *F. Cunia*.
    - Leaves not unequal-sided; petioles 1-4 in. long.
      - Leaves lanceolate . . . . 14. *F. glomerata*.
      - Leaves broad-ovate, with deeply cordate base . 15. *F. Roxburghii*.
  - Leaves opposite . . . . 16. *F. hispida*.

1. **F. bengalensis**,* Linn.—Syn. *F. indica*, Roxb. Fl. Ind. iii. 539;

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* There is some doubt as to what tree was intended by Linnæus under the name of *F. indica*, and I follow Miquel in calling the *Banyan*, *F. bengalensis*, though Roxburgh referred it to *F. indica*, Linn. The tree which Miquel refers to *F. indica*, Linn., is mentioned at p. 415.

Urostigma bengalense, Gasp.; Wight Ic. t. 1989. *Banyan.*—Sans. *Vata.* Vern. *Bor, bar, bera, bargat,* Hind.; *War,* Bombay.

A large tree with spreading branches, sending down numerous slender roots, which descend to the ground and afterwards become trunks. Leaves alternate, approximate near the ends of branches, ovate, entire, obtuse, base cordate or rounded, 3-5-nerved, the midrib with 4-6 pair of main lateral nerves, joined by fine transverse reticulate and distinct intramarginal veins, coriaceous, smooth above, soft-tomentose pubescent or glabrate beneath, blade 4-8, petiole 1-2 in. long, a broad smooth gland at the top of the petiole on the under side; stipules sheathing, leaving annular scars on branchlets. Receptacles sessile, axillary, each receptacle supported by 2-4, more or less connate, broad obtuse bracts. Male and female fl. in the same receptacle mixed with long linear bracteoles; perianth 3-4-parted, male fl. monandrous. Fruit globose, pubescent, red when ripe, ½ in. diam.

Commonly planted by Hindoos throughout India, as far north as Peshawar, in the outer Himalaya as high as 4000 ft. Wild in the forest tracts of the sub-Himalayan tract, Oudh, Bengal, and Central India, irregularly distributed, common in places, and wanting in others. In North India the leaves are renewed in March and April; the fruit ripens April, May, and remains long on the tree; the young foliage has a brownish colour. The Banyan sends down aerial roots from the branches to a greater extent than any other Ficus; they root in the ground and grow into trunks, which serve as a support for the horizontal branches, and as feeders, thus gradually increasing the diameter of the crown. Many specimens are known in Bengal with the crown 200-300 ft. in diameter and larger. Grows 70-100 ft. high, the main stem generally of moderate girth. In North-West India the rootdrops are much less numerous and strong than in the moister and warmer climate of Bengal and the peninsula, but the trunk attains a large size, 25 or 30 ft. girth being not uncommon, and trees exist even in the dry climate of the Panjab, with numerous rootdrops covering considerable areas. The bark is 1 in. thick, grey, but darker coloured than that of the Peepul, smooth and even, with circular shallow furrows, inner bark pale-red, fibrous. The bark of old stems often exfoliates in flat roundish scales. Wood open-grained, not durable, whitish, with concentric wavy bands of lighter-coloured tissue. Medullary rays numerous, distinctly marked. Pores large, few, often in pairs; the cub. ft. weighs 30-36 lb., and Skinner gives the value of P. at 600. Hindoos do not generally fell the tree, but the wood is occasionally used for boxes, door-panels, and is said to be valued for well-rings. The rootdrops are tough and elastic, and are used for tent-poles, poles for carrying loads, also for cart-yokes. A coarse brown cordage is made of them, which the Sikhs used largely for slow-matches for their matchlocks. Birdlime is prepared from the acrid milky juice; when dried it has the form of dark-brown lumps. Brahmins use the leaves as plates, and leaves and twigs are a favourite fodder of cattle and elephants. Lakh is collected from the tree in some parts of the eastern and central Panjab and in Ceylon, not in Sindh. The fruit is sweetish, and is eaten during times of scarcity; it is greedily devoured by birds. The leaves are applied to bruises, and the bark is used in native pharmacy. Like other sp. of *Ficus*, the Banyan often grows from seeds left by birds in the fork of another tree, whence it sends down aerial roots, which gradually form a network of thick woody roots or stems, enclosing the trunk of the parent tree, which is buried in the mass of the Ficus, and at last perishes. Trees killed in this manner by epiphytic Ficus are called *Nyaungthat* in Burma. The Toddy palm (*Borassus flabelliformis*) is often seen thus encircled by the Ficus, the crown alone appearing.

2. **F. tomentosa**, Willd.; Roxb. l. c. 550; Wight Ic. t. 647.—Syn. *Urostigma tomentosum* and *obversum*, Miquel; Hook. Journ. Bot. vi. (1847) 573.

A large tree, throwing out roots from the branches, which do not, however, grow large; branchlets, petioles, and under side of leaves grey-tomentose. Leaves coriaceous, elliptic- or obovate-oblong, acute, base cordate, lateral nerves 6-8 pair, the lowest pair basal; transverse and intramarginal veins distinct; blade 3-7, petiole ½-1½ in. long. Receptacles axillary, in pairs, tomentose. Fruit ¼ in. across, grey, woolly, supported by 3 large tomentose bracts.

Banda district, Behar, and probably Satpura range. Western Ghats of Canara and Mysore.

F. mysorensis, Roth—Syn. *Urostigma mysorense* and *dasycarpum*, Miq., is closely allied, but has larger oblong fruit and 12-15 pairs of main lateral nerves. A large tree, yielding excellent shade, in Malabar, Canara, and the Konkan. Ceylon. Common in the western forests of Mysore.

3. **F. infectoria**, Willd.; Roxb. Fl. Ind. iii. 551; Wight Ic. t. 665.—Syn. *F. venosa*, Ham.; *Urostigma infectorium* and *U. Tjakela*, Miq. l. c. 566, 567. Sans. *Plaksha*. Vern. *War, var, batbar, jangli pipli, palākh, trimbal*, Pb.; *Pilkhan* (also in Pb.), *ramanjīr*, N.W.P.; *Pakhar, pakharia*, Oudh, N.W. and C.P.; *Keol, kaim, khabar, pakri, sohun pākar*, C.P.

A large tree, young shoots slightly pubescent. Leaves coriaceous, glabrous, shining, abruptly acuminate; main lateral nerves 8-12 pair, alternating with shorter intermediate nerves, the lowest pair from the base; blade 4-8 in., petiole 2-3 in. long. Receptacles sessile, axillary, in pairs, each supported by 3 small bracts. Style filiform, stigma long, penicillate. Fruit globose, ¼ in. diam., white when ripe.

Not uncommon on the lower hills of the Suliman range trans-Indus, in the Salt range, the Siwalik tract, and outer Himalaya, ascending to 4000 ft. in the Panjab, to 5000 ft. in Kamaon. Common in the Oudh forests, Bengal, Burma, and the Central Provinces. West side of the peninsula from the Konkan to Malabar. The leaves are renewed between Feb. and April; the fruit ripens May, June, and often remains on the tree until the ensuing year's fruit is formed. Attains 40-50 ft., trunk short, irregularly shaped, not rarely sending down single roots from stem or branches. Often found as an epiphyte on other trees. Bark grey, even, but exfoliating in long strips; inner substance fibrous, tough, milky. Wood reddish- or brownish-white. The cub. ft. weighs 30 lb. Not durable. The young shoots are eaten in curries, and the leaves are used as fodder for cattle and elephants. A good avenue-tree, grows rapidly, quicker than *Siris*.

4. **F. Wightiana**, Wall.; Benth. Fl. Hongk. 327.—Syn. *Urostigma Wightianum* and *perseæfolium*, Miq. in Hook. Journ. Bot. vi. (1847) 566, 567.

A large tree, wholly glabrous. Leaves ovate-oblong, shortly acuminate; main lateral nerves 6-8 pair, with intermediate slender ones, the lowest pair basal, intramarginal veins distinct; blade 3-6 in., petiole 1-1½ in. long. Receptacles axillary, in pairs, sometimes in the axils of fallen leaves, pedunculate, peduncles 1 line long. Fruit subglobose, ⅓-½ in. diam, supported by very small bracts.

South India, Ceylon, Hongkong. I refer to this sp. specimens collected by R. Thompson in the Baraich forests of Oudh ("a small tree"). Dr Stewart, however, referred them to *Urostigma Pseudo-Benjamineum*, Miq. l. c. 566, which he, as well as Beddome, Manual Fl. Sylv. 223, identify with *F. comosa*, Roxb. Cor. Pl. t. 125; Fl. Ind. iii. 552. *F. comosa* is described and figured by Roxb. with slender, often pendulous branchlets, and oval, long-acuminate leaves tapering into a slender petiole about 1 in. long. Fruit contracted at the base, rich deep yellow or purple when ripe, the size of a gooseberry. Tinnevelly hills and mountains on the east side of the peninsula.

This group of Indian figs to which *F. Wightiana* and *comosa* belong, demands farther study on the spot. Nearly allied to them are the two following species: 1. *F. Tsiela*, Roxb. l. c. 549; Wight Ic. t. 668; Bedd. Fl. Sylv. t. 314; Miq. Ann. Mus. Lugd. Bat. iii. 286—Syn. *Urostigma Pseudo-Tiela*, Miq. (1847) 566. A large tree with smooth bark, wholly glabrous, leaves ovate, long-petiolate; lateral nerves slender, numerous, some more prominent than the others; fruit turbinate, purple when ripe. Bengal, mountains of South India. 2. *F. indica*, Linn. Syst. Veg. 922; Miq. Ann. Mus. Lugd. Bat. iii. 287—Syn. *U. Tjiela*, Miq. Hook. Journ. Bot. vi. 580, with thick-coriaceous, shining, short-petiolate leaves. East Bengal, Burma, Philippine Islands.

5. **F. religiosa**, Linn.; Roxb. Fl. Ind. iii. 547; Bedd. Fl. Sylv. t. 314. —Syn. *Urostigma religiosum*, Gasp.; Wight Ic. t. 1967. *Peepul.* Sans. *Pippala.* Vern. *Pipal*, Hind.; *Pipro*, Panch Mehals; *Ravi*, Telugu; *Baude nyaung*, Burm.

A large tree wholly glabrous, with irregularly-shaped trunk and wide-spreading branches. Leaves drooping, coriaceous, shining, broad-ovate, 3-4 in. broad, edge undulate, with a long narrow acumen (1-3 in. long), basal nerves 5-7, midrib penniveined, basal and lateral nerves anastomosing by close and prominent reticulate veins, petiole slender, generally as long as greatest breadth of leaf. Receptacles sessile, generally in pairs, axillary, each receptacle supported by 3 obtuse pubescent bracts, often splitting as the receptacle expands. Male and female flowers in the same receptacle, mixed with lanceolate bracteoles; perianth 3-4-parted, male flowers monandrous. Fruit subglobose, somewhat flattened, ½ in. across, dark purple when ripe.

Commonly planted by Hindoos throughout India, and by Buddhists in Ceylon and Burma. This tree is peculiarly sacred to the Buddhists. Rare in the arid tract of North-West India. In the outer Himalaya planted trees are found as high as 5000 ft. Wild in the forests of the sub-Himalayan tract, Bengal, and Central India. Not indigenous in Burma. In North and Central India the tree is leafless during a short time, generally only for a week or two; the leaves are renewed between February and April, the young foliage is reddish. The fruit ripens during the hot season, in April, May in the Panjab, and sometimes as late as Oct., Nov. (Centr. Prov., R. Th.) Attains 80-90 ft., trunk short, most irregularly shaped, fluted and buttressed, of large girth, 25-30 ft., not uncommon, Stewart mentions a tree 25 ft. girth at 5000 ft. in Chamba, and another of 36 ft. in Sindh. The roots spread wide near the surface, and are often above ground. Bark thick, light-grey, smooth, on old trunks rough with large exfoliating scales, inner substance red, fibrous, milky.

The seed of the Peepul, like that of the Banyan, often germinates on roofs, walls, and on other trees. The Peepul is particularly destructive to buildings. It is often found as an epiphyte on *Dalb. Sissoo*, *Bauhinia purpurea*, and other trees. *Loranthus* and other parasites are not generally found on this species or on *F. infectoria* and *glomerata*. The wood is pinkish-white, with narrow concentric bands of lighter colour, open-grained, not strong or durable. Medullary rays marked, showing like narrow horizontal bands on a vertical section. Pores few, large. The cub. ft. weighs 44½ lb. (Cunningham, Gwalior), 34 (Skinner); the value of P. is 458 according to Cunningham's, and 584 according to Skinner's experiments. The tree, being sacred, is rarely felled; the wood is used as fuel and to make packing-cases. In Central India the young leaf-buds are eaten as a vegetable by the hill tribes during times of scarcity, the twigs and leaves are a favourite fodder of elephants; Roxburgh states that silkworms like the tender leaves of this tree next to the Mulberry leaves. Stick-lakh is largely produced on the Peepul in Central India. Apart from being a sacred tree, it is planted on account of its dense shade, and is easily raised from seed and cuttings. In the Panjab cuttings do not succeed so well as those of the Banyan. Grows more rapidly than *Sissoo*, *Siris*, or even *Albizzia procera*. At high elevations (4000 ft.) the extremities are often nipped by frost. The leaves, bark, and fruit are officinal in native medicine. The skeleton leaves are used for painting by the Chinese artists.

6. **F. cordifolia**, Roxb. l. c. 548 (not Blume *).—**Tab. XLVIII.**—Wight Ic. t. 640.—Syn. *Urostigma cordifolium*, Miquel in Lond. Journ. Bot. vi. (1847) 564. *Ficus populiformis*, Schott; Miquel Mus. Lugd. Bat. iii. 287, perhaps *F. terminalioides*, Griffith, and *affinis*, Gr. Ic. Pl. As. t. 550, 553. Vern. *Rūmbal*, *palāk*, *badha*, *pilkhan*, Pb.; *Kābar*, *gajiūn*, *gajua*, *pīpal*, N.W.P.; *Gagjāira*, Oudh; *Pakar*, *khabar*, C.P.; *Pakri*, Assam; *Paīr*, Bomb.

A large tree. Leaves wholly glabrous, shining, ovate, acuminate, with rounded or cordate base, edge undulate, basal nerves 3-5, midrib pennineined, basal and lateral nerves joined by closely reticulate and distinct intramarginal veins, prominent in young, less distinct in old leaves, blade 4-5, petiole 2-3 in. long. Receptacles sessile, axillary, in pairs, each supported by 3 bracts, male and female flowers in the same receptacle, perianth 3-4-parted, male flower monandrous. Fruit globose, black when ripe, ½ in. diam.

Wild; here and there, not common, in the Siwalik tract and outer Himalaya, ascending to 5000 ft., and extending west to the Chenab. Bengal, Central India, and Western Ghats near Bombay. The leaves are renewed in March, and the fruit ripens in May and June. Attains 40-50 ft., trunk short, of irregular shape, deep-furrowed and fluted, girth 7-8 ft., branches numerous, spreading. Resembles *F. religiosa* on a small scale. Often epiphytic, embracing other trees and killing them. Bark 1 in. thick, yellowish grey, longitudinally wrinkled, with hard scales exfoliating. Wood pinkish white. The leaves are used as cattle-fodder. The fruit is eaten. In the Durrung district of Assam it is cultivated for rearing the lakh insect (G. Mann).

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* *F. cordifolia*, described from Java by Blume (Bijdragen, 1825, 438), has priority, as Roxburgh's Flora, though written early this century, was not published until 1832, but has, according to Miquel Mus. Lugd. Bat. iii. 260, not been found since Blume's time. Under these circumstances, Roxburgh's well-known name for a well-known tree may be permitted to stand for the present, pending a revision of this difficult genus.

7. **F. retusa**, Linn.; Benth. Fl. Hongk. 327; Fl. Austr. vi. 166.—Syn. *F. Benjamina*, Roxb. l. c. 550. *F. nitida*, Thunb.; Wight Ic. t. 642. *F. pallida*, Wall. (?) *Urostigma pisiferum* and *ovoideum*, Miq. in London Journ. Bot. vi. (1847) 581.

A large handsome tree with dense foliage, wholly glabrous. Leaves coriaceous, shining, oval or obovate, acute or short-acuminate, blade 2-3 in. long, narrowed into petiole ½ in. long; main lateral nerves numerous, slender, not very prominent. Fruit subglobose, ⅓ in. diameter, sessile, axillary, solitary or in pairs, purple when ripe, with small yellowish specks (Roxb. Fl. Ind.); the Ill. in Hb. Kew, No. 688, has greyish yellow fruit.

Kamaon (Kosilla valley at 3000 ft., Strachey & Winterbottom), Banda, Bengal, South India, Ceylon, Indian Archipelago, Burma, China, North Australia, Queensland. Dense shade, makes an excellent avenue-tree. Specimens collected in Oudh, not seen by me, identified by Dr Stewart with this species, are described by R. Thompson as from a small epiphytic tree, with full dark-green foliage.

F. Benjaminea, Linn., has slender drooping branches, elliptic or broad-ovate, shortly petiolate leaves, elegantly marked with numberless fine parallel lateral veins, close together, and joined along the edge by a distinct intramarginal vein. Fruit ¾ in. diameter. East Bengal, Burma, Indian Archipelago, Queensland. This species, as well as *F. retusa*, is called *Nyaung-thabieh* (*Eugenia Ficus*) in Burmese.

F. elastica, Blume; Bijdragen tot de Flora van Nederlandsch Indie, 446; Roxb. Fl. Ind. iii. 541; Wight Ic. t. 663; Griff. Ic. Pl. As. rar. t. 552—the *Assam Caoutchouc-tree*—vern. *Borgach*, *attah bar*, Assam; *Kagiri*, Kasia (Griffith); *Kasmir*, Silhet (Roxb.),—is a large tree, with irregularly-shaped stem and spreading branches, from which roots descend to the ground. The leaves are thick-coriaceous, shining, elliptic, midrib very prominent, with numberless straight parallel fine lateral veins, nearly at right angles to the midrib, blade 3-6 in. long, on seedlings and root-shoots much longer, stipules long, sheathing, rose-coloured. Fruit ovoid, greenish yellow, the size of an olive. Sub-Himalayan tract from Sikkim to the extreme eastern boundary of Assam, foot of the hills at the head and on the south side of the Brahmaputra valley. Pandua and Jantipur hills, which bound the Silhet valley on the north. The tree towers above the surrounding forest; Griffith (Journ. As. Soc. vii. i. 1838, 132) describes a specimen, 100 ft. high, circumference of main trunk 74 ft., of trunk and supports 120 ft., of area covered by the branches 610 ft. The Assam Caoutchouc, when pure, is a superior article, but it seems certain that Para rubber, the produce of several species of *Hevea* (p. 445), retains its firmness longer and is more suitable for work requiring great elasticity and power of resistance. In Assam, however, it is often mixed, not only with pieces of bark, wood, sand, stones, but also with the milk of other species of Ficus which is inferior in quality.

F. elastica is a free and rapid grower, easily propagated by cuttings, and its cultivation in Assam on a large scale will doubtless prove successful. In Germany, where it is commonly grown as an ornament of drawing-rooms, it was formerly known under the name of Berlin weed. It is cultivated in gardens throughout the tropics and as an avenue-tree in Java. In that island, however, it seems also to be indigenous; Blume (l. c.), in 1825, states that it grows on limestone, gives the vernacular names as *Karet, karet tapok*, and describes a variety, *bengalica* (introduced from Calcutta *), with acuminate, undulate leaves. In the Preface to Rumphia, ii. (1836), he says that the Java tree is capable of yielding Caoutchouc. Miquel, Fl. Ind. Bat. i. ii. 348, makes three species—*Urostigma elasticum* (introduced), *U. Karet* and *odoratum* (indigenous in Java); but in his latter work, Ann. Mus. Lugd. Bat. iii. 287, he unites the three under *F. elastica*, Nois (evidently a misprint for Nobis in Blume). A species nearly allied to *F. elastica* is *F. macrophylla*, Desf. Queensland and New South Wales. There is no proof of *F. elastica* being indigenous in Australia. (Benth. Fl. Austr. vi. 170.)

F. laccifera, Roxb. l. c. 545; Wight Ic. t. 656,—vern. *Kathal Bat*, Silhet, —a large tree, wholly glabrous, with large, firm, shining, ovate or elliptic, short-acuminate leaves, petioles 1-2 in. long, with 3 basal and 4-8 main lateral nerves on either side of midrib, and numerous fine intermediate nerves between; fruit sessile, axillary, ovoid, the size of a gooseberry—is said to be tapped for Caoutchouc, like *F. elastica*. This tree grows in Assam, Silhet, the Andamans, Malabar (Beddome Man. 223), and probably in Burma; the Caoutchouc yielded by it merits farther examination. In Silhet Lakh is collected from its branches.

8. **F. Carica**, Linn.—*Fig-tree.* Vern. *Anjīr.* Local names: *Kimri, fāgu, fagūri, fagāri*, Pb.

A middle-sized deciduous tree, with glabrous, smooth, grey or brown branches, the branchlets of the current year pubescent. Leaves cordate, 3-5-nerved, dentate, and more or less deeply lobed, lobes obtuse, blade 4-8, petiole 2-3 in. long, upper side rough, under side tomentose; stipules early deciduous. Receptacles pedunculate, axillary, turbinate, narrowed into a stalk, and supported at the base by a few membranous, early deciduous bracts. The receptacles which appear first, in the lower axils, are androgynous, containing a few male, with numerous female flowers, those which appear later in the year, in the upper axils, only produce female flowers. Male fl. near the mouth of the fig, perianth-segments 3-5, stamens 1-5, generally 3, filaments longer than perianth. Female fl.: perianth-segments 3-5, ovary sometimes 2-celled, style lateral, filiform, bifid at the top. Fruit, when ripe, yellow or dark purple, greatly varying in size and colour.

Cultivated in the plains of N.W. India, and in the outer hills of the N.W. Himalaya, as high as 5000 ft., also in the Dekkan. Cultivated largely in Beluchistan and Afghanistan, and said to be wild about Kandahār. Cleghorn (Panjab Forests, 177) states that Figs are indigenous (but small) in Kaghan. The Fig-tree is indigenous in Syria and Palestine, and its cultivation in those countries is as old as that of the vine. In South Europe it is completely naturalised, and is not uncommonly found in an apparently wild state. Hardy in England. In the Panjab the fruit generally ripens from May to August. Bark whitish or light grey, smooth or finely rugose. Wood soft, white with a yellowish tinge. Figs are an important article of food in Western Asia. In Afghanistan, numerous varieties are cultivated (*makkai* with black, *sada* with white fruit). The Figs grown in India are generally poor. Dried Figs are used extensively in native pharmacy (Pharm. Ind. 215). Gasparrini, an Italian botanist, studied the classification of the genus, the varieties of the (apparently) wild and cultivated Figs, and the process of caprification, an old practice, by which it was supposed that the setting and ripening of the Fig was promoted. He established the genera *Urostigma* and *Covellia* (p. 412), and divided the common Fig-tree (*F. Carica*) into two genera, *Ficus* and *Caprificus*, each of which he subdivided into numerous species. Gasparrini distinguishes *Caprificus*, which comprises the wild Figs, the fruit of which is not eatable, from *Ficus* by the 3-partite female perianth, and the ovary always 1-celled, but the minute sexual organs of this genus, which develop themselves in a crowded state, pressing against each other, while the delicate parts of the flower are being formed, present great variation and irregularity, the limits of which for each species are as yet only imperfectly known. The kind called by Gasparrini *Caprificus* is generally inhabited by an insect (*Psenes caprifici*), and it was an old practice in Greece, described by Aristotle and Theophrastus, to plant the Capri Fig by the side of the Fig, or to suspend the fruits of the one to the branches of the other, the supposition being that the insect enters the unripe fruits of the domestic Fig and causes them to set or accelerates their ripening. This practice of caprification seems to have spread to South Italy from Greece, and it is still practised in parts of these two countries, as well as in Asia Minor, though it is unknown in Spain, the South of France, and, as far as I am aware, in Afghanistan and India. Numerous endeavours to explain the rationale of this practice have been made by scientific men ever since the time of Theophrastus, the generally accepted opinion being that the insect promotes the fertilisation of the Fig, making an opening by which the pollen escapes, or by carrying the pollen from the Figs with male flowers to those which have only female flowers. Against this stands the fact, that many kinds of Fig attain maturity with sterile seeds—that is, seeds in which the embryo has not been developed, and therefore fecundation is not an essential condition to the ripening of Figs. Gasparrini, however, not satisfied with general objections, made a series of interesting experiments, which he published in 1845, from which it would appear that caprification has no effect whatever on the ripening of the Fig, and that, however old the practice of Greek and Italian gardeners may be, its advantage or usefulness can in no way be established. Twenty years later (in 1865), the same author published the result of experiments, which he had undertaken to investigate another practice of the Neapolitan cultivators, called puncturation, which consists in anointing the mouth of the unripe Fig, when it has arrived at a certain size, with a very small quantity of olive oil. There is no doubt that this practice advances maturation by about ten days, and Gasparrini found that, while the application of other liquids was without any effect, most oils or fatty substances, as well as most acids (particularly tartaric and diluted sulphuric acid), if applied to the scales at the mouth of the fig, had the effect of considerably accelerating maturity. These remarkable experiments seem to suggest the possibility of an action by the insect upon the development of the fruit, which has not yet been discovered. English translations of these two interesting memoirs will be found in the Journal of the Horticultural Society of London, iii. 185, and New Series, ii. 1.

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* Blume may have received the name *F. elastica* from the Bot. Garden, Calcutta, but it is not included in Roxburgh's Hortus Bengalensis, and the Flora Indica did not appear until 1832, so that Blume must stand as the authority.

Ficus Sycomorus, Linn.—Syn. *Sycomorus antiquorum*, Gasp., is a large, spreading, very shady tree, common in Egypt and Abyssinia, planted in avenues near Cairo, and believed to attain a great age. Branchlets, petioles, and nerves hairy; leaves coriaceous, glabrate, upper side shining, broad-ovate with cordate base, entire or repand; basal nerves 3, midrib penniveined. Receptacles on leafless paniculate branchlets from the trunk or larger boughs, male and female flowers in distinct receptacles. The wood was used by the old Egyptians for mummy cases.

9. **F. virgata**, Roxb. Fl. Ind. iii. 530; Wight Ic. 649.—Syn. *F. caricoides*, Roxb. l. c. 529; Wight Ic. t. 634 (probably). Vern. *Anjir*, *inzar*,

Afg.; *Fāgu, fog, fāg, fagōru, dhūdi, dhūra, phedu, kak, kok, daholia,* Pb. hills; *Fagwāra, thapur,* Pb. plains; *Gūlar, khabāra, anjīri, beru, bedu,* N.W.P.

A small or middle-sized tree with hoary or pubescent branches, branchlets of the current year, as well as petioles, young shoots and young leaves soft-tomentose. Leaves rough above, soft-tomentose beneath, broad-ovate, dentate, not or very rarely lobed, 3 basal nerves, and 4-6 pair of main lateral nerves on midrib; blade 3-5, petiole 1-2 in. long. Receptacles tomentose, pedunculate, axillary, pear-shaped, not stipitate when young, but when farther advanced narrowed into a stalk, which lengthens out and often attains ½ in., being supported at its base by 3-4 ovate membranous bracts, mouth half closed with numerous cordate ciliate scales; peduncle ½-¾ in. long. Fruit yellow when ripe, ½-1 in. diam. Leaves of this sp. sometimes slightly resemble those of *F. Roxburghii,* but these have more prominent transverse veins, and the upper surface always glabrous, never rough or tomentose. The branchlets of *F. Roxburghii* are hollow, those of *F. virgata* solid with large pith, like those of *F. Carica.* From *F. Carica* it is best distinguished by tomentose branchlets and the rarely lobed leaves, which are less rough than those of the common Fig. There is some doubt regarding *F. caricoides,* which is represented by Roxb. in Ill. Hb. Kew, 1730, with larger leaves and the fruit not, or very shortly stipitate.

Common wild on the eastern slopes of the Suliman range, ascending to 5000 ft., and in the plains of the trans-Indus territory, in the Salt range, the Siwalik tract, and outer hills, extending eastward to Nepal, and ascending to 5000 ft. (on the Sutlej to 9000 ft.) Urni the upper limit in Kunawar. Oudh forests, plains of the Panjab. Cultivated in N.W. India, in Sindh, Beluchistan, and Afghanistan. The leaves are renewed in March, the fruit ripens June-Oct. The tree resembles *F. Carica* in habit so much as to be easily confused with it; the trunk is short, 6-7 ft. girth (one of 10 ft. noted by Dr S.), with a rounded bushy crown, but it often is only a shrub. Bark of a dull-grey colour (ashy white, Madden), very smooth, with only a few small scars and specks. In the plains the fruit is not generally eaten, in the hills it is eaten largely, and is often succulent, sweet, and pleasant.

10. **F. parasitica,** Koenig; Thwaites Enum. 266; Miq. Ann. Mus. Lugd. Bat. iii. 292.—Syn. *F. Ampelos,* Koen.; Roxb. Fl. Ind. iii. 553; Wight Ic. t. 652. *F. excelsa,* Vahl; Roxb. l. c. 552.

A large tree, or epiphytic on other trees. Leaves rough on both sides, or on the under side only, short-petiolate, elliptic-oblong, entire, main lateral nerves 7-10 pair, joined by reticulate and distinct intramarginal veins, blade 5-6, petiole ¼ in. long. Receptacles pubescent, in pairs, axillary, pedunculate. Male flowers few, monandrous, perianth-segments 3-5, linear, hairy. Female flowers: perianth of 5-6 long, linear, hairy segments; style lateral, short, stigma indistinctly lobed. Fruit yellow when ripe, subglobose, ⅓ in. diam.

Kamaon, at the foot of the hills, Banda, Behar, Bengal, South India, Ceylon. Often epiphytic, encircling the stems of other trees with its anastomosing roots. The leaves are used to polish ivory (Roxb.)

11. **F. scandens**, Roxb. l. c. 536; Wight Ic. t. 643. (Not *F. scandens*, Roxb. of Stewart Pb. Plants, 214.)

A climbing shrub; leaves coriaceous, rough on both sides, or on the under side only, short-petiolate, ovate, entire, main lateral nerves 4-6 pair, with shorter intermediate nerves between, the lowest pair basal, joined by slender reticulate and intramarginal veins, blade 4-6, petiole ¼-1 in. long. Receptacles in pairs, axillary, pedunculate, but not stipitate, supported at the base by 3-4 ovate bracts. Male flowers few, monandrous; perianth of both sexes red, glabrous, of 4 linear segments. Style lateral, short, stigma 2-lobed. Fruit subglobose, ⅓ in. diam., yellowish-green when ripe, peduncle ½ in. long.

Kamaon, Parisnath in Behar, Eastern Bengal.

Ficus radicans, Roxb. l. c. 536; Wight Ic. t. 671—Syn. *F. urophylla*, Wall., is a scandent shrub with rooting stems, often epiphytic. Leaves short-petiolate, elliptic or elliptic-oblong, suddenly narrowed into a long linear apex, midrib, nerves and veins very prominent beneath, impressed on the upper side of leaf, main lateral nerves 3-4 on either side of midrib, anastomosing by stout intramarginal transverse and reticulate veins. Fruit axillary, subglobose, pedunculate, ¼ in. diam., yellow or orange when ripe. East Bengal, Burma, Indian Archipelago.

12. **F. trachycarpa**, Miq. in Hook. Journ. Bot. vii. (1848) 430; Ann. 291.

A shrub or small tree, with rough branchlets. Leaves rough, short-petiolate, oblong-lanceolate, long-acuminate, dentate with large distant teeth, main lateral nerves 6-8 pair, arcuate, blade 4-6 in., acumen (tail) 1 in., and petiole ¼ in. long. Receptacles axillary, solitary, short-pedunculate, male and female flowers in one receptacle. Male flowers: perianth gamophyllous, segments 3-5, hairy; stamens 1 or 2, anthers versatile, cells parallel, distinct. Female flowers: perianth-segments linear, ciliate, generally 5. Ovary stipitate, style short, lateral, bifid at the top, but early deciduous. Fruit ovoid, ¾ in. long, rugose with a very uneven surface, on short peduncle.

Sutlej valley near Rampur, Kamaon, ascending to 5000 ft. Sikkim, Kasia hills, Burma. Fr. May, June.

13. **F. Cunia**, Buch.; Roxb. l. c. 561; Wight Ic. t. 648; Miq. Ann. Mus. Lugd. Bat. iii. 296.—Vern. *Khewnau*, Garhwal; *Khūrhūr*, Oudh; *Kassæ*, Gorakhpur; *Ghwi*, C. Prov.

A small or sometimes a large tree, branchlets scabrous. Leaves alternate, bifarious, unequal-sided, oblong-lanceolate, acuminate, serrate, rough on both sides, under side soft-tomentose while young, base semicordate, the lower half forming a large rounded, projecting, 3-nerved lobe; main lateral nerves 8-12 pair, with prominent transverse veins, blade 6-15, petiole ½ in. long. Fruit turbinate, ribbed, pedunculate, in pairs or in threes, in long leafless panicled racemes from the trunk, often several feet long.

Sub-Himalayan tract, ascending to 4000 ft. in the outer hills, and extending west to the Chenab. Oudh forests, in ravines and water-courses. East Bengal, Parisnath, Coromandel coast, Burma. The principal crop of the fruit ripens in

Aug., Sept. In Oudh it only attains 12 ft., with a girth of 2 ft. It is said that the leaves are used for polishing wood. The fruit is eaten.

F. conglomerata, Roxb. l. c. 559, Wight Ic. t. 669, is probably the same species; it is said to differ by shorter leaves and sessile receptacles.

14. **F. glomerata**, Roxb.—**Tab. XLIX.**—Cor. Pl. t. 123; Fl. Ind. 558; Wight Ic. t. 667.—Syn. *Covellia glomerata*, Miq. Sans. *Udumbara.* Vern. *Kathgūlar, krūmbal, rumbal, kakammal, dadhūri*, Pb.; *Gūlar, paroa, lelka*, N.W.P.; *Gūlar*, Oudh, Banda; *Umar, Umrāi, tue*, C.P.; *Thapan, yay thapan*, Burm.

A middle-sized or large tree, youngest shoots pubescent. Leaves lanceolate, glabrous when full-grown, entire, under side pale, and covered with minute green dots, main lateral nerves 6-8 pair, the lowest pair near the base, blade 4-6, petiole 1-2 in. long. Receptacles pedunculate, downy, in short thick paniculate clusters on the trunk and larger branches. Male flowers few, near the mouth of receptacle, perianth of broad, very thin, hyaline segments closely enveloping each other, enclosing 1 or 2 unequal stamens, filaments short, connate at the base. Female flowers mostly long-pedicellate. Fruit subglobose, 1-2 in. diam., downy, red or orange coloured when ripe.

Salt range (rare), Siwalik tract and outer Himalaya. Common in Oudh and the Gangetic plain. Bengal, Central and South India. Generally on the banks of streams and rivers. North Australia and Queensland (Benth. Fl. Austr. vi. 178). Often planted, also in the plains of the eastern Panjab. The fruit generally ripens from April to July; the leaves are renewed between Jan. and April. Attains 40-60 ft., and a girth of 5-8 ft., with a short stem and large spreading branches. Stewart measured an old hollow tree in the Bias valley of 14 ft. girth, and trees 80-100 ft. high have been reported from the Sutlej. Bark ½ in. thick, grey or brown, without cracks or furrows, but in old trees occasionally rough from exfoliating scales. Wood reddish or brownish grey, no distinct heartwood, the cub. ft. weighs 36.26 lb. (Cunningham, Gwalior), 26.5 lb. (R. T., Cent. Prov.) From Cunningham's experiments, the value of P. appears to be between 403 and 513. Lasts well under water, but is otherwise not durable. It is used for well-frames. The tree abounds in milky juice, from which bird-lime is made; the leaves are used for cattle- and elephant-fodder. The ripe fruit is eaten; in times of scarcity the unripe fruit is pounded, mixed with flour, and made into cakes. Leaves, bark, and fruit are used in native medicine.

15. **F. Roxburghii**, Wall.; Miq. Ann. Mus. Lugd. Bat. iii. 296.—Syn. *F. macrophylla*, Roxb. Fl. Ind. iii. 556 (not Desf.); Wight Ic. t. 673. *F. sclerocarpa*, Griff. Ic. Pl. As. t. 558 (?) *Covellia macrophylla*, Miq. Hook. Journ. Bot. vii. 465. Vern. *Urbūl, urmūl, baru, tūsi, trimbal, trīmal, tramal, tirmi, tiamle*, Pb.; *Trimmal, tīmal, timla*, N.W.P.

A middle-sized tree, with hollow branchlets; under side of leaves hoary or with soft grey pubescence. Leaves broad-ovate, with deeply cordate base, acute, irregularly dentate, 3 basal and 4-6 main lateral nerves on either side of midrib, joined by prominent transverse veins at right angles to basal and lateral nerves; blade 6-18 in. long, petiole 1-4 in. Fruit tubercled, hairy, yellowish green, tinged with red when ripe, turbinate, 1-2 in. long, 2-3 in. broad, marked with 8-12 longitudinal ridges, mouth closed with numerous cordate scales, pedunculate, in clusters of 6-20, on short thick leafless branchlets, on the trunk and at the base of main branches.

Siwalik and outer Himalaya, ascending to 5000, and in places to 6000 ft., and extending west to the Indus. Silhet and Chittagong. Fruit ripens (in North India) March-May. Trunk short erect, dividing into a few stout branches, which spread into a broad shady crown. The leaves are valued as elephant- and cattle-fodder. The fruit is eaten and sold in bazaars; its flavour is not unpleasant. Wood heavier and harder than that of other species.

F. triloba, Ham.; Miq. Ann. Mus. Lugd. Bat. iii. 290—Syn. *F. hirsuta*, Roxb. Fl. Ind. iii. 528; Wight Ic. t. 670; *F. hirta*, Roxb. l. c. 531; *F. Roxburghii*, Miq. Lond. Journ. Bot. vii. 456, is a tree of Eastern Bengal, belonging to another section of the genus, branches leaves and receptacles densely clothed with ferruginous tomentum, leaves large, cordate or 3-lobed, fruit large, sessile, axillary, in pairs, hairy, of a rich yellow colour, ovoid, thick fleshy, supported at the base by 3 ovate acuminate bracts, perianth deeply 3-5-parted, red, male fl. diandrous.

16. **F. hispida,** Linn. fil.; Benth. Fl. Austr. vi. 176.—Syn. *F. oppositifolia*, Roxb. Cor. Pl. t. 124; Fl. Ind. iii. 561; Wight Ic. t. 638; Griff. Ic. Pl. As. t. 560. *F. dæmonum*, Koenig; Roxb. l. c. 562; Wight Ic. t. 641. Sans. *Kako dumbara* (the Crow's *Udumbara*). Vern. *Dadūri, degar, rūmbal*, Pb.; *Kāgsha, gobla, totmila*, Kamaon; *Kat gularia*, Oudh; *Dhēdu mera*, Panch Mehals.

A small or middle-sized tree, young luxuriant shoots hollow, nodes marked by annular scars, branchlets rough with short stiff hairs. Leaves all opposite, ovate- or obovate-oblong, entire or dentate, rough above, tomentose beneath, main lateral nerves 4-6 pair, the lowest pair from the base of leaf, joined by prominent transverse veins, blade 4-8 in., petiole 1-2 in. long. Receptacles pedunculate, sometimes axillary in pairs, more generally clustered on leafless, often long pendulous branchlets from the old wood on trunk and branches. Male flowers: a few near the mouth of receptacle, monandrous, perianth of 3 or 4 broad hyaline segments enveloping each other. Female flowers numerous, pedicellate; perianth thin and transparent; ovary stipitate, stigma large, funnel-shaped. Fruit obovoid, hairy, with 6 longitudinal ridges, 1 in. long, greenish when ripe.

Siwalik tract and outer Himalaya, ascending to 3500 ft., and extending west to the Chenab. Abundant (in moist ravines) in the Oudh forests. Common in Bengal and the Central Provinces. Panch Mehals, South India, Ceylon, Burma, Indian Archipelago, North Australia and Queensland. The leaves are renewed Feb., March; the fruit ripens April, May, and often remains long on the tree. Usually a small tree, but attains 60 ft. in Sikkim. Bark thin, grey or greenish, rough, inner bark milky. Wood coarse-grained, very light, 24¼ lb. per cub. ft. P.=360 (Kyd). The acrid milk is used medicinally in Kangra. The tree is much lopped for cattle-fodder.

The following frutescent species of *Ficus*, which are found in the North-West Himalaya, may be briefly mentioned here: 1. *F. foveolata*, Wall. Cat. No. 4493; Griff. Ic. Pl. As. t. 561, ii.; scandent, branches often rooting, branchlets, petioles, under side of leaves and peduncles hairy, leaves short-petiolate, coriaceous, oblong-lanceolate, main lateral nerves 6-10 pair, alternating with shorter ones, all anastomosing by prominent reticulate and intramarginal veins. Fruit axillary, pedunculate but not stipitate, hairy, subglobose, supported at its base by 3 membranous bracts. Style long filiform, undivided. Wangtu bridge, Sutlej valley, Kamaon, ascending to 7500 ft., Sikkim, Bhutan (a middle-sized tree, with red, fleshy fruit, Griff. It. not. 137), Kasia hills. Probably = *F. reticulata*, Miq. Ann. iii. 294 (identified with *F. scandens*, Roxb., in Stewart Pb. Plants, 214), and *F. Luducca*, Roxb. 534; Madden As. Soc. Journ. xviii. i. 644—Vern. *Kabra*, Almora.

2. *F. nemoralis*, Wall. Cat. 4517. Glabrous. Leaves membranous, lanceolate, long-acuminate, main lateral nerves arcuate, 10-16 pair, with numerous shorter intermediate ones, joined by very fine, distinct, but not prominent reticulate veins, blade 5-6, petiole ½ in. long. Male fl. numerous, mixed with females, 2-3-androus; perianth red, of 3-4 lanceolate segments, anthers large, basifixed, on short filaments; female perianth of 3-4 lanceolate subconcave segments; style short. Fruit globose, ½ in. diam., in pairs, pedunculate but not stipitate, supported at its base by 3 acute membranous bracts. Outer Himalaya, from the Jhelam to Sikkim, ascending to 7000 ft.

3. *F. pubigera*, Wall. Cat. No. 4518, identified by Miquel with *F. erecta*, Thunb. (Ann. Mus. Lugd. Bat. iii. 294). Extremities and petioles hairy. Leaves glabrous, or with floccose hairs beneath, oblong-lanceolate, entire, long-acuminate, main lateral nerves 8-10 pair, blade 5-8, petiole ½ in. long. Fruit hairy, globose, ⅜ in. diam., short-pedunculate but not stipitate. Kamaon, ascending to 3000 ft. Nepal, Sikkim, Assam, Kasia hills.

A remarkable shrub, of the subgenus *Covellia*, common on banks of rivers and in rocky river-beds in Sikkim, Kasia, the hills of Oudh and Kamaon, is (4.) *F. tuberculata*, Wall. Cat. No. 4539 (but not of Roxburgh). S. Kurz (Journal As. Soc. of Bengal, xlii. pt. ii. 1873, 106) identifies it with a similar shrub which grows in Pegu and Martaban (*F. pyrrhocarpa*, Kurz), but the identity of the Burman and North Indian species seems doubtful. The North Indian shrub has rough and hairy branchlets, lanceolate opposite leaves, approximate near the ends of branches, 5-7 in. long, narrowed into a short hairy petiole, harsh on both sides with short adpressed hairs, stipules lanceolate, persistent, hairy; receptacles hairy, with circular raised tubercles, and a few scales on the outer surface, pedunculate, on short leafless bracteate panicles from the old wood; perianth of female fl. none or early caducous, style long filiform, hairy. Farther inquiries may perhaps identify it with, either *F. lanceolata*, Buch., Roxb. l. c. 557; Miq. Ann. iii. 297, or *F. laminosa*, Hardwicke; Roxb. 531; Madden As. Soc. Journ. xviii. i. 643—Vern. *Chancherri*, the leaves used to feed cattle.

5. *F. heterophylla*, Linn. fil.; Roxb. Fl. Ind. iii. 532; Wight Ic. t. 659, is a straggling shrub, with alternate, short-petiolate, very rough leaves, either undivided oblong, or variously lobed. Receptacles axillary in pairs, pedunculate, yellow when ripe, with whitish scabrous spots. On the banks of rivers and in moist places generally. Oudh, Banda district (Edgeworth), Bengal, South India, Ceylon.

6. *F. repens*, Willd.; Roxb. l. c. 535; Wight Ic. t. 636, is a small scandent or procumbent shrub, with rooting stems, common in grass-lands of Oudh, Bengal, Burma and South India; leaves alternate, long-petiolate, very rough, ovate, often with cordate base, undivided or variously lobed. Fruit obovoid, narrowed into a long stalk, supported at the base by bracts, the stalk as long as or longer than the axillary solitary peduncle. Male fl. few, near the mouth of receptacle, monandrous, perianth of 4 hyaline oblong segments; female fl. numerous, perianth of 5 thin hyaline lanceolate segments; style short, undivided.

9. CUDRANIA, Trecul.

Spinose shrub with alternate leaves and axillary globose flower-heads. Flowers dioicous. Male fl.: perianth of 4-5 narrow segments, concave and obtuse above. Stamens 4, pistil rudimentary. Female fl. of 4 imbricate concave segments. Ovary free, 1-celled, with a solitary pendulous ovule; style simple, stigma filiform. Nuts free, enclosed in the consolidated fleshy perianth and receptacle; pericarp crustaceous. Albumen scanty or 0.

1. **C. javanensis**, Trecul; Benth. Fl. Austr. vi. 179 (not Wight Ic. t. 1960).—Syn. *Maclura javanica*, Blume Mus. Bot. Lugd. Bat. ii. t. 31. *Trophis spinosa*, Wall. Vern. *Mānda, mandei, kangu*, N.W.P.

A straggling shrub, armed with axillary, straight or curved, spines; branchlets pubescent. Leaves subcoriaceous, glabrous, short-petiolate, 1-4 in. long, elliptic or elliptic-oblong, acuminate, acute or obtuse, entire, penniveined and reticulate, but veins not prominent. Flower-heads pubescent, globose, axillary, solitary or 2 together, short-pedunculate, the males ¼ in. diam., the females smaller at first, but increasing, when mature, to ¾ in. or more. Male flowers closely packed, perianth leaves 3-5 distinct, often unequal, cuneate, the upper part concave and hairy outside. Filaments short, not inflexed in bud, inserted round a glabrous, subulate rudimentary ovary, anthers oblong, 2-celled. Female flowers crowded, more or less immersed in the fleshy receptacle. Leaves of perianth 4, upper part thickened and velvety. Style one, short, barely exserted. Fruit a compound, irregularly-shaped berry as large as a small Custard apple (Madden), formed of the enlarged fleshy perianths and receptacle, each perianth enclosing a one-seeded nut.

Dehra Doon, Garhwal, Rohilkhand, Nepal, Oudh, Sikkim, Kasia, Burma, Ceylon, Eastern Africa, Indian Archipelago, Queensland, and New South Wales. Fl. April-June; fr. Aug.-Nov. Bark smooth, yellowish brown or blackish, marked with white oblong lenticels. Wood used as fuel.

10. ARTOCARPUS, Linn.

Evergreen trees with milky juice; leaves alternate. Flowers monoicous. Male and female in distinct, globose or cylindrical heads. Male flowers: perianth 2-3-4-phyllous, segments free or connate, concave, imbricate in æstivation. Stamen 1, exserted. Female flowers: perianth tubular, entire, with a minute mouth. Ovary free, 1-locular (rarely 2-3-locular), with a solitary pendulous ovule; style terminal or lateral, simple or 2-3-fid), stigma various. Nuts enclosed in the persistent perianths, which are consolidated in a large fleshy syncarpium. Seed exalbuminous.

Nearly glabrous; branchlets with annular scars . . . . 1. *A. integrifolia.*
Extremities and under side of leaves grey-tomentose; branchlets without annular scars . . . . 2. *A. Lakoocha.*

1. **A. integrifolia**, Linn.; Roxb. Fl. Ind. iii. 522; Wight Ic. t. 678; Bot. Mag. t. 2833, 2834. *Jack-tree.*—Sans. *Panasa.* Vern. *Kanthal, katol, kathal*, N.W. India; *Phanās*, Bombay; *Pein nayben*, Burm.

A large tree, glabrous, only youngest shoots with short stiff hairs; branchlets with annular raised lines, the scars of the stipules. Leaves coriaceous, smooth, shining above, rough beneath, elliptic or obovate, obtuse, midrib prominent beneath, with 7-8 main lateral nerves on either side of midrib; blade 4-8 in., petiole ½-1 in. long, stipules large, with a broad amplexicaul base, sheathing in bud, early caducous; leaves of young plants and of shoots from the root often lobed. Flower-heads ovoid, elongated, on short lateral branchlets, generally on the trunk or larger branches. Fruit large, hanging on short stalks, oblong, fleshy, with a thick cylindrical receptacle and a muricated rind 12-30 in. long and 6-12 in. diam. Seeds reniform, oily.

Cultivated in N.W. India (rare in the Panjab, and not beyond Lahore), in Oudh, Bengal, Central and South India, Burma, Ceylon, and the Indian Archipelago. Regarding its native home, there is yet some uncertainty. Rumphius (Herbarium Amboinense, i. 106) states that it grows in the forests of Ceylon, like other forest trees, but Thwaites, Enum. Pl. Ceyl. 262, is of opinion that it cannot be considered truly indigenous. In the Indian Archipelago the tree is believed to be cultivated only, and in Burma, though the Jack is often found in large and dense forests (*e. g.*, in the Attaran district), yet I have only found it in the vicinity of deserted settlements. According to Wight l. c. and Beddome (Fl. Sylv. Manual, p. 219), the tree is wild in the mountain forests of the western Ghats, ascending to 4000 ft. Fl. Dec.-Feb.; fr. May-July. Attains 40-50 ft., with a short erect trunk of great girth, and a dense shady crown. Bark thick, often with deep cracks, inner substance soft. Sapwood white, heartwood yellow when fresh cut, reddish brown when seasoned, the wood of old trees somewhat resembling mahogany in colour and appearance. Takes a beautiful polish. Medullary rays sharply defined, light-coloured, of moderate width, pores large, uniformly distributed, each pore in a patch of yellow tissue, often in concentrically arranged patches or interrupted bands. Weight between 42 and 45 lb. per cub. ft. Value of P. 788, Skinner; between 513 and 889, Puckle; fracture splintery. Warps and cracks unless well seasoned. Used for carpentry and furniture, and imported into England for cabinet-work, turning, and for brush-backs. A yellow dye is made of the wood. The leaves, bark, and the rind of the fruit abound in a tenacious white milk, used as bird-lime. The fruit is an important article of food in Burma, South India, and Ceylon, the seeds are roasted and eaten. Young trees bear fruit on the branches, older trees on the trunk, and very old trees often at the base of the trunk near the root.

Other species with amplexicaul stipules and annular scars on branchlets are: 1. *A. Chaplasha*, Roxb. l. c. 525; Wight Ic. t. 682—Vern. *Chaplash*, Beng., *Taun peinnayben* (Mountain Jack), Burm., a gigantic timber-tree of East Bengal and Burma, wood prized for canoes, structure similar to that of *A. integrifolia*. Leaves of young plants pinnatifid, of old trees entire; flower-heads globose, long-pedunculate; fruit globose, the size of a large orange. 2. *A. hirsuta*, Lam.; Roxb. l. c. 521; Bedd. Fl. Sylv. t. 308; *Angeli wood*. Vern. *Heb Halsu*, Canar., a most valuable timber-tree of the evergreen forests of the western Ghats, male fl. in long cylindrical spikes; fruit ovoid, size of a large lemon, the tops of perianths enlarging and forming numerous hispid spines. Wood strong, close-grained, of a yellowish brown colour, highly prized for ship-building and other purposes, weight per cub. ft. 36-40 lb., P. = 744. 3. *A. incisa*, Linn.; Bot. Mag. t. 2869-71, *the Bread fruit-tree*, a native of the South Sea Islands, but now introduced into most tropical countries; bears fruit on the western coast, in Ceylon, and in Burma. Leaves pinnatifid, with a connate base 1-3 ft. long, male fl. in club-shaped spikes.

2. **A. Lakoocha**, Roxb. Fl. Ind. iii. 524; Wight Ic. t. 681.—Sans. *Lakucha*. Vern. *Tiūn, dheu, daheo*, Pb.; *Dhau, dahū*, Kamaon; *Barhal*, Banda, Behar; *Dēphūl*, Bengal; *Myauklouk*, Burm.

A large tree; branchlets and under side of leaves with soft grey tomentum. Leaves coriaceous, oval or ovate, obtuse or short-acuminate, entire, blade 6-10 in., petiole ½-1 in. long, upper side glabrous, shining, under side soft-tomentose, 10-14 pair of prominent main lateral nerves; stipules lanceolate, with a narrow base, not sheathing, deciduous. Flower-heads globose, axillary, the male subsessile, the female short-pedunculate. Fruit acid, of an irregular roundish shape, 3-4 in. diam., velvety, yellow when ripe.

Outer hills of Kamaon, ascending to 4000 ft. Sikkim, East Bengal, Burma. Evergreen forests of the western Ghats, Ceylon. Occasionally planted in the Siwalik tract of the Panjab, rarely in the plains. Attains 50-60 ft., with a short trunk of great girth. Bark ½ in. thick, light- or dark-grey, rough, but without cracks or furrows. Sapwood large, whitish, heartwood yellowish or dark red-brown, structure similar to that of *A. integrifolia.* Weight 40 lb. per cub. ft., D.B., Burma List, 1862. Used for furniture, in Burma canoes are made of it. The male flower-heads are pickled, and the fruit is eaten.

Antiaris innoxia, Blume—Syn. *A. saccidora*, Dalz. & Gibs.; Bomb. Fl. 244; Wight Ic. t. 1958; Bedd. Fl. Sylv. t. 307,—is one of the largest, Beddome says the largest tree of the evergreen forests of the western Ghats, and the hills between them and the coast. Found as far north as Kandala, also in Ceylon. Leaves elliptic-oblong, rough, short-petiolate; female flowers solitary, enclosed in an involucre of connate imbricate bracts, sessile, with 2 styles; male fl. crowded on a thick flat receptacle; fruit fleshy, purple, 1-seeded. Sacks are made of the thick woolly fibrous inner bark, described as follows in Graham's Catalogue, 193: "A branch is cut corresponding to the length and diameter of the sack wanted, soaked a little, and then beaten with clubs until the liber separates from the wood. This done, the sack formed of the bark is turned inside out, and pulled down, until the wood is sawed off, with the exception of a small piece left to form the bottom of the sack, and which is carefully left untouched." In Ceylon rope is also made of the bark.

Another sp. of the same genus is found in the dense evergreen forests of the Thoungyeen valley in Tenasserim (*Myah seik*, Burm.), the juice is used by the Karens to poison arrows, but the poison does not seem equal in its effects to that of the famous Upas tree of the Indian Archipelago (*Antiaris toxicaria*, Lesch.; Blume Rumphia, i. t. 23). The largest tree which I ever measured in Burma belonged to this species; it grew in the evergreen forest of the Thoungyeen, was 250 ft. high, and had a girth of 38 ft., the trees of the surrounding evergreen forest having an average height of 200 ft. (Attaran Forest Report, 1860, p. 55). Beddome states that *A. innoxia* attains a similar size on the western Ghats.

The Caoutchouc exported from Mexico, Central America, the West Indies, and Ecuador is the produce of the *Ulè* tree, *Castilloa elastica*, Cervantes, and perhaps a second species of the same genus. It is a superior article, and the introduction of the tree into India seems desirable. *C. elastica* is a large tree, branchlets and under side of leaves with long soft rust-coloured tomentum; leaves short-petiolate, oblong. Flowers monoicous, female flowers numerous, on plane circular lateral receptacles (Collins' Report on Caoutchouc, 1872, 11).

The *Palo de Vaca* or *Cow* tree of Caracas (*Galactodendron utile*, Kunth; Bot. Mag. t. 3723-24), a gigantic tree with coriaceous shining leaves, has been referred to the genus *Brosimum.* From incisions made in the trunk it yields large quantities of thick gluey milk without any acridity, drunk extensively, and very wholesome and nourishing. *Brosimum* has one female flower inside a subglobose receptacle, covered on the outside with numerous stamens and peltate bracteoles. The *snake* or *letter wood* of the West Indies, Guiana, and Mexico, a beautiful heavy dark-coloured wood with small pores and numerous very fine medullary rays, which on a vertical section appear like linear bands with sharply defined and exactly parallel sides, is the produce of a tree of this genus, *Piratinera guianensis* of Aublet, the *Bois de lettres*, a large tree of Guiana, identified by Pöppig with *Brosimum Aubletii* of the Huallaga river in North Peru, and by Miquel with *Brosimum discolor*, Schott, a small tree of Brazil. Another species, *B. Namagua*, Seemann, of New Granada and Central America, has a thick woolly fibrous inner bark, which is made into beds, garments, and ropes, and used as sails in the native canoes (Hooker's Journal, iii. (1851) 269).

11. CELTIS, Tournefort.

Trees or shrubs, with alternate stipulate leaves. Flowers polygamous, in axillary or lateral cymes. Perianth deciduous, of 4-5 segments, imbricate in bud. Stamens as many as, and shorter than, perianth-segments, in the male flowers surrounding a rudimentary ovary inserted on a hairy disc. Ovary on a hairy disc, stigmata 2, sessile, deciduous. Fruit an ovoid or globose drupe, with a hard, coriaceous or bony kernel.

1. **C. australis**, Linn.—**Tab. L.**—Reichenb. Ic. Fl. Germ. 1338, t. 667. —Syn. *C. tetrandra*, Roxb. Fl. Ind. ii. 63; *C. caucasica*, Willd.; *Micocoulier*, Fr.; *Perlaro, bagolaro*, It.; *Zürgelbaum*, Germ. Vern. *Tagho, takhum*, Afg.; *Brimlu, khirk, khalk, khark, khirg, kū, roku, choku, bramji, batkar, kāi, bigni, biūgli*, Pb.; *Kar*, Kunawar; *Tagha*, Sindh; *Kharak, kharīka, khirk*, N.W.P.

A middle-sized deciduous tree, with bifarious branches; young leaves, branchlets, and petioles hairy. Leaves ovate or ovate-lanceolate, unequal-based, acuminate, more or less rough when full-grown, serrate, the lower third of the leaf often entire, 3 basal nerves, the midrib penniveined, blade 3-5 in., petiole ½ in. long; stipules subulate, caducous, shorter than petiole. Flowers yellowish-white, tetramerous or pentamerous, bisexual flowers axillary, pedicels more than twice the length of petiole, the male flowers on shorter pedicels, in lateral fascicles or short racemes, below the leaves, or in the axils of the youngest leaves. Drupe ovoid, ⅓ in. long, putamen reticulate-rugose, seeds oily.

Afghanistan, ascending to 8800 ft. Suliman range trans-Indus. Salt range. Himalaya, ascending to 8500 ft., from the Indus to Bhutan. Kasia hills. Also in western Asia and the Mediterranean region. Upper limit on the Sutlej: Jangi right, Morung left bank. Frequently planted in the Panjab plains and the N.W. Himalaya, in Sindh and Beluchistan. Fl. March-May, before the leaves appear, or with the first leaves; fr. July-Sept. Attains 30-40 ft.; trunk short, straight, 6-8 ft. girth, one noted 16 ft.; branches spreading. Bark ½ in. thick, bluish-grey, or brown, smooth or rough with brown and whitish, often raised specks, not furrowed, but frequently with numerous small cracks and circular wrinkles, the trunk often appearing as if constricted with cords. Growth generally slow. Wood light-coloured, close- and even-grained, hard and tough, a continuous belt of large pores in the spring wood, other pores smaller, uniformly distributed, joined by narrow undulating often zig-zag lines of whitish tissue. Hardy in England.

In the North-West Himalaya churn-sticks are made of it, and it is used as fuel and for charcoal. The wood of the European Celtis varies much in weight—sp. grav. 0.66-0.88 (41 to 54 lb.)—though not so much as the wood of the Ash, which also has a continuous belt of large pores in the spring wood. In the south of France it is cultivated extensively in coppice-woods ; oars, hoops, whip-handles, and similar articles requiring tenacity and elasticity, are made of it. In the Himalaya it is chiefly planted for shade and fodder, and the winter supply of hay is often stored in its branches. The bark is used for sandals (Cleghorn). The fruit is insipidly sweet and has not much flesh. It is eaten: a larger, blackish or dark purple kind is called *roku* on the Sutlej ; a smaller, yellow or orange kind, *choku*.

Aitchison (Cat. 139) notes *C. caucasica*, Willd., from the Jhelam, the Salt range, Kashmir, Kamaon, and (cultivated) Sindh. My opinion is that all the *Celtis* of North-West India with glabrous fruit belong to one species, which I identify with *C. australis*, L.

C. eriocarpa, Decaisne in Jacq. Voy. Bot. t. 152, from Kamaon, differs from *C. australis* by ovate-lanceolate leaves and a pubescent ovary and drupe, but it seems doubtful whether it is specifically distinct. Stewart identifies this with *C. Acata*, Hamilton, and gives its distribution and vernacular names as follows: Eastern skirts of the Suliman range trans-Indus. Salt range 2000-3000 ft. Himalaya from the Indus south-eastward, ascending to 4500 ft., Kamaon, Nepal, and Oudh. Vern. *Tagha*, Afg. ; *Batkar*, *bat taman*, Pb. ; *Akata* (whence the specific name), *katāia*, Hindi.

C. Roxburghii, Planch.—Syn. *C. trinervia*, Roxb. Fl. Ind. ii. 65 (not Lam., which is a West Indian species), has subcoriaceous, ovate, acuminate, almost glabrous leaves, entire or dentate near the apex, fertile flowers often in pairs (on slender axillary racemes, Dalz. Bomb. Fl. 238). South India, Bengal, Burma. Dr Stewart states that this species is found (rare) in the Siwalik tract of the Panjab and Kamaon, also (not common) in the Central Provinces, and gives the following vernacular names: *Kharak*, *batkar*, *brūmaj*, *brūndu*, Pb. ; *Cheri chara*, *kathūniār*, C.P. I have not seen specimens from N.W. and Central India.

In the xvii. vol. of De Candolle's Prodromus, Planchon refers the *Celtis* of North-West India to the following species :—

1. *C. caucasica*, Willd. Leaves oblique- or rhomboid-oblong-ovate, acuminate, triplinerved. Stipules linear, longer than petioles of young leaves, ovary slightly pubescent at the base of the style ; kernel slightly reticulate. Caucasus, North Persia, Cabul, Beluchistan, Salt range, Kashmir.
2. *C. eriocarpa*, Decaisne. Leaves lanceolate ; drupes grey-tomentose. Panjab.
3. *C. tetrandra*, Roxb. Leaves subcoriaceous, ovate or ovate-oblong cuspidate, with an unequal-sided base, triplinerved, drupe wholly glabrous, kernel slightly rugose. Kamaon, Nepal, Silhet, Nilgiris ("common, vern. *Adona*"), and to this species he refers the following as synonymous : 1. *C. glabra*, Planch. Kamaon. 2. *C. serotina*, Planch., Wight Ic. t. 1970. 3. *C. Acata*, Hamilton in Trans. Soc. Linn. xvii. 201. Bengal, Behar. 4. *C. nepalensis*, Planchon. Kamaon, Tenasserim, Andamans. He does not say that he identifies with it 5. *C. Roxburghii*, Planch. Ann. Sc. Nat. iii. series x. 302 (*C. trinervia*, Roxb.), but seems to imply that it belongs to this species (Prodr. xvii. 179).

12. **SPONIA**, Comm.

Trees with alternate 3-nerved serrate leaves. Flowers monoicous, in axillary cymes. Perianth persistent, tube short, limb of 5 segments, concave, induplicate in bud, slightly overlapping, nearly valvate. Stamens

5, longer than perianth. Fruit a minute drupe, supported by the persistent perianth, and crowned, while half ripe, by 2 short stigmatose styles.

Leaves rough on both sides, oblong-lanceolate; male cymes compact, as long as petiole	1. *S. politoria.*
Leaves soft-tomentose beneath, ovate; cymes spreading, longer than petiole	2. *S. orientalis.*

1. **S. politoria,** Planch.; DC. Prodr. xvii. 202.—Syn. *Celtis politoria,* Wall. Vern. *Bantamman, kanglu, khūri,* Pb.; *Jāun, khasaroa, mārni, bātu,* N.W.P.; *Banharria,* Oudh; *Khāksi,* Nepal.

A small tree with short trunk and bifarious exceedingly rough leaves, branchlets rough with long hard white hairs. Leaves oblong-lanceolate, with almost equal-sided base, 2-5 in. long, penniveined, serrate, pale beneath, rough on both sides with scattered hairs and the raised base of numerous fallen hairs, main lateral nerves arcuate, 4-6 pair, the lowest pair from near the base of leaf, petiole ¼ in. long; stipules deciduous, longer than petiole. Cymes of male flowers as long as petiole, of female flowers a little longer than petiole.

Salt range. Siwalik tract and outer hills from the Chenab to Nepal. Abundant in the Oudh forests in dry sandy or stony places. Sikkim, Central Provinces. The leaves are renewed in March and April. Fl. April-June. Attains 15 ft. and a girth of 12 in., with a few spreading branches. Bark ¼ in. thick, greenish-white, or reddish-brown, smooth or with longitudinal wrinkles, inner bark red, viscid, fibrous. Wood reddish nut-brown, fibrous and elastic, with a moderately close-grain (R. T.) The leaves are as hard as sand-paper and are used to polish wood and horn.

2. **S. orientalis,** Planch.; DC. Prodr. xvii. 200.—Syn. *Celtis orientalis,* Linn.; Roxb. Fl. Ind. ii. 65. Probably not different from *Sponia Wightii,* Pl.; Wight Ic. t. 1971; Bedd. Fl. Sylv. t. 311. *Indian Nettle-tree, Charcoal-tree.* Vern. *Badu manu,* C.P.; *Gol,* Bombay.

A small rapidly growing and short-lived tree with pubescent branchlets. Leaves ovate, acuminate, 3-nerved, obtusely serrate, base unequal-sided, cordate, soft-tomentose beneath, and more or less rough on the upper side, midrib with 3-4 pairs of main lateral nerves; stipules deciduous, as long as petioles of young leaves. Cymes lax, spreading, considerably longer than petiole. Stigmas covered with long threads. Drupe black when ripe.

Nepal, Bengal, Satpura range (not common), South India, Ceylon. Forms part of the secondary growth where the evergreen forest has been cleared in Western Mysore and Coorg. Has been planted in Wynaad for shade in coffee plantations, where the original forest had been imprudently cleared away. Fl. April-June (the greater part of the year, Roxb.) Attains 30 ft. with an erect short trunk, 2-3 ft. girth. Bark dark grey or blackish, smooth. The inner bark is tough and strong.

S. velutina, Planch.; Benth. Fl. Hongkong. 324, branchlets and under side of leaves soft-pubescent. China, Indian Archipelago, Burma, Bengal; is probably not specifically distinct.

13. ULMUS, Linn.

Trees or shrubs with alternate, simple, more or less distichous, unequal-sided leaves and caducous stipules. Flowers bisexual, in lateral fascicles. Perianth campanulate, generally persistent, 4-5- or 8-9-fid, segments imbricate in bud. Stamens as many as perianth-lobes, adnate to the tube of perianth, and opposite to its segments; anthers fixed by the back. Ovary free, 1-2-celled; styles 2, papillose on the inner face, 1 ovule in each cell. Fruit an indehiscent flat samara, surrounded on all sides with a broad membranous wing, on an articulate pedicel. Seed pendulous, no albumen, embryo straight, radicle superior.

In the following synopsis I have included, besides the North Indian species, the more important of the European Elms, as some of them are closely allied to the North-West Himalayan species.

Leaves entire; perianth deciduous; ovary long-stipitate .	1. *U. integrifolia.*
Leaves serrate; perianth persistent; ovary subsessile.	
Stamens and perianth-segments 5-8; flowers appear before the leaves.	
Pedicels more than twice the length of perianth; stamens and perianth-segments 5-8.	
Articulation of pedicel near its base, lower portion much shorter than upper; samara not fringed at edges	2. *U. Wallichiana.*
Articulation of pedicel near the top; lower portion much longer than upper; samara fringed at the edge with long hairs	3. *U. effusa.*
Pedicels less than twice the length of perianth; stamens and perianth-segments 5-6.	
Seed in the middle of samara	4. *U. montana.*
Seed near upper end of samara	5. *U. campestris.*
Stamens and perianth-segments 4; flowers appear with the leaves	6. *U. parvifolia.*

1. **U. integrifolia,** Roxb. Pl. Cor. t. 78; Fl. Ind. ii. 68; Bedd. Fl. Sylv. t. 310.—Syn. *Holoptelea integrifolia,* Planch. DC. Prodr. xvii. 164; Wight Ic. t. 1968. Vern. *Pāpri, khulen, arjān, rajāin, kachām,* Pb.; *Papar, kanju,* Kamaon; *Papri,* Bhartpur; *Dhamna, kūnj,* Oudh; *Karanji, chilbil, chilmil, kūmba, kūnja nāli, begana,* Cent. Prov.; *Chilla,* Banda; *Wawali,* Mar.; *Navili chettu,* Tel.

A large deciduous tree, usually glabrous, only inflorescence pubescent. Leaves coriaceous, elliptic, acuminate, entire, those of seedlings and root-shoots sometimes serrate, blade 3-5, petiole ⅓ in. long, main lateral nerves 5-7 pair. Male and bisexual flowers mixed, in cymose lateral fascicles. Perianth hairy, nearly cleft to the base, segments 5. Stamens in bisexual flowers 5, in male flowers 8, anthers hairy, no rudiment of ovary in male flowers. Ovary stipitate, compressed, generally 1-celled. Samara oval or suborbicular, unequal-sided, 1 in. long, on a long slender articulate pedicel, the upper portion being the elongated stalk of the ovary, often with the remains of the perianth at its base. A variety with pubescent extremities and under side of leaves from Ceylon.

Sub-Himalayan tract, extending west to the Bias, but rare between Jumna and Bias. Common in Garhwal and Kamaon, ascending to 2000 ft. Abundant in the Gonda and Baraich forests of Oudh, and in the Banda district, not uncommon in the Satpura range. Behar, South India, Ceylon, Burma. Often planted in North and Central India. Prefers a dry, sandy or shingly soil. The leaves are shed between Sept. and Jan., the fresh leaves appear in March and April, soon after the flowers, which come out in Feb.-March. The fruit ripens June-Aug., and remains long on the tree. A fast-growing tree, attains 60-70 ft., with a tall straight stem, 20-30 ft. clear, and 6-8 ft. girth, with short buttresses, furrowed and scooped out higher up. Bark thick, pale- or dark-grey or light-brown, with small tubercles in lines, and longitudinally rugose, not cut up by cracks or furrows, smelling unpleasantly when bruised. Wood yellow or light-brown, soft and open-grained, light but strong. Medullary rays very fine, pores moderate-sized, uniformly distributed, annual rings distinct. No distinct heartwood. Employed in building, for carts, carving, durability uncertain. Much used for fuel and charcoal. The leaves are lopped for cattle-fodder, and the tree is often used to stack fodder for winter supply.

2. **U. Wallichiana**, Planch.—**Tab. LI.**—DC. Prodr. xvii. 158. In Herb. Wall. as *U. erosa*, Roth, and *U. effusa*, Willd. Vern. *Kāin*, *khāi*, *bren*, *brera*, *brān*, *brānkul*, *brori*, *amrāi*, *marāri*, *marāl*, *marrūn*, *marran*, *marazh*, *makshari*, *manderung*, *maldung*, *shko*, *kummār*, Pb.; *Himbareh*, Kullu, Cleghorn; *Mored*, *pabūna*, *chambar maya*, N.W.P.

A large deciduous tree, branchlets with rough pubescence. Leaves 4-8 in. long, elliptic, long-acuminate, main lateral nerves 15-20 pair, each terminating in a large serrature, the outer edge of which is serrulate, petiole ¼ in. long; stipules membranous caducous. Flowers bisexual, fasciculate, in short lateral racemes, common peduncle pubescent, 1 in. long, pedicels fasciculate, 3-6 from one point, the portion below the articulation pubescent, much shorter than the upper glabrous portion. Perianth persistent, turbinate, glabrous, segments 5, obtuse, ciliate. Samara short-stipitate, obovate, pubescent, seed about the middle, wing reticulate. The indumentum of the leaves varies exceedingly, in some specimens the leaves are soft-pubescent or tomentose on both sides, in others they are rough, in others again they are glabrous above, and pubescent or rough beneath. Dr Stewart referred this sp. to *U. campestris*.

Not uncommon in the North-West Himalaya, from the Indus to Nepal at 3500 to 10,000 ft., often planted, also cultivated at Kabul. Fl. early in spring, while the tree is leafless; the fruit ripens May-June. Attains 80-90 ft., trunk erect, often of immense size, tapering from a broad base, 12-16 ft. girth, in cultivated and protected trees to 24 ft. Old stems mostly hollow. The branches are erect at times, which gives the tree a poplar-like appearance. Bark whitish, light- or dark-grey, or dark brown, very rough, with long diagonal cracks, cutting the outer bark into diamond-shaped exfoliating scales. Wood brown, not much valued in the Himalaya. The bark is tough and very strong; cordage, sandals, and slow-matches are made of it. The leaves are lopped extensively for cattle-fodder.

3. **U. effusa**, Willd.; Reichenb. Ic. Fl. Germ. 1337, t. 666.—Syn. *U. pedunculata*, Fougeroux; DC. Prodr. xvii. 154.

A large tree, trunk often buttressed at the base, flowers drooping on long slender pedicels, in lateral fascicles on the previous year's wood. Samara fringed at the edge with long hairs, on long slender pedicels, the lower portion below the articulation, 3-5 times the length of the upper portion.

Eastern Europe. Flowers in spring before the leaves. Wood not much valued. Specimens very similar to this found by T. Thomson in Kashmir at 5000 ft. (April 1848, at Ganderbal) are in the Kew herbarium, but flowers and young fruit are subsessile.

4. **U. montana**, Sm.; Hook. Stud. Fl. 334; Reichenb. Ic. Fl. Germ. 1332, t. 662. *Wych* or *Mountain Elm. Bergrüster*, Germ.

A large forest tree, with lax foliage and drooping branchlets, bark peeling off in linear or oblong scales. Leaves rough, ovate-oblong, long-acuminate, 3-6 in. long, base very unequal-sided. Flowers subsessile in lateral clusters on the previous year's wood. Seed in the centre of the samara.

Indigenous in Scotland, the north of England, Norway (to 65° N.L.), and in other parts of North Europe, Flowers in spring before the leaves. Not rarely mixed with Beech in the forests of France and Germany. Japan and North-Eastern Asia, not in Siberia. Wood highly prized, on the Harz it fetches a higher price than Oak. On a horizontal section the spring wood appears as a continuous belt of large pores, the outer parts of each annual ring having much smaller pores in narrow wavy concentric bands. On a vertical section the large pores of the spring wood are very prominent, and the medullary rays appear as straight horizontal bands with parallel sides.

5. **U. campestris**, Spach; Willk. Forstl. Fl. 476; Hook. Stud. Fl. 334; Reichenb. Fl. Germ. 1331, t. 661. *Common Elm. Feldrüster, ulme*, Germ.; *Orme*, Fr.; *Olmo*, It.

A large tree with stiff, often brittle branches, bark dark, nearly black, with deep longitudinal furrows, often corky, especially along the branches (*U. suberosa*, Ehrh.) Leaves rough, 2-3 in. long, base often nearly equal. Flowers subsessile, in lateral clusters on the previous year's wood. Seed above the centre of the samara. .

Indigenous in Central and South Europe, naturalised, not indigenous in England, commonly planted in parks and avenues. North Asia, Turkestan, North China, Japan, Syria, Armenia, Caucasus, and probably Afghanistan. Flowers in spring before the leaves. In France the wood of this species is valued higher than that of *U. montana* for cart and machine building, and for many other purposes; but it requires long and careful seasoning (Mathieu, Fl. For. 207). In England the branches of this elm are exceedingly brittle. The structure of the wood resembles *U. montana*. Weight 35-55 lb.

To *U. campestris* I am inclined to refer (with Dr Cleghorn, Pb. Forests, 79) the small-leaved elm of the N.W. Himalaya. Leaves 2-3 in. long, base nearly equal-sided, glabrous, or slightly rough or pubescent, flowers and fruit unknown. Not common, and generally near villages, in the N.W. Himalaya, on the upper Jhelam, Chenab, Bias, Sutlej, and Indus, and in the Nubra valley, ascending to 10,500 ft.—Vern. *Yūmbok*, Ladak; *Brān, brahmi, kāi, morūn, marāl, māuru, mannu, māndu, mamji, meru, merinu, bhamni*, Pb.; *chipāl*, in the Pb. plains. Some of the specimens resemble *U. pumila*, Linn., a small shrub of Siberia, with subsessile fasciculate flowers and glabrous campanulate perianth, which, however, Maximowicz considers as merely a variety of *U. campestris*, L. (Diagnoses plant. nov. Jap. Decas xiii. 22). In the inner Himalaya, it is generally found as a small shrub along the river-beds, but it is often planted near villages, and is then a middle-sized tree, with thick trunk, attaining a girth of 20-

30 ft. and more. Bark brown, surface whitish between deep dark-coloured longitudinal regular furrows, running diagonally into each other. Straight woody spines (the base of dead branches) often project from the wood into the bark. The wood is valued more than that of the large-leaved elm (*U. Wallichiana.*)

6. **U. parvifolia,** Jacq. Pl. Rar. Hort. Schœnbrunn. t. 262.—Syn. *U. virgata,* Roxb. Fl. Ind. ii. 67 ; Wall. Pl. As. rar. t. 290.

A slow-growing shrub or tree, branchlets pubescent. Leaves coriaceous, smooth, glabrous, oblong-lanceolate, short-petiolate, 2-4 in. long, serrate, main lateral nerves branching, 14-16 pair. Flowers reddish, appearing with the leaves, male and fertile mixed, in lateral scaly fascicles, lower part of pedicel pubescent, much longer than the glabrous upper part (above the articulation). Perianth campanulate, glabrous, segments 4, obtuse, ciliate. Stamens 4. Samara obliquely oval, glabrous, short-stipitate, seed in the middle, wings reticulate.

Kamaon, Sikkim, 4000-5000 ft., Bhutan, Burma, China, Japan. Introduced into the Bot. Garden, Calcutta, from China. The bark peels off like that of the Plane tree (C. Koch, Dendrol, ii. 423). Fl. Sept. (Nagasaki), Nov. (Calcutta), Sept., Oct. (Vienna), May, June (C. Koch). In Japan planted in hedges. Probably evergreen, or leafless only for a short time. *U. virgata,* Wall. Cat. No. 3548 : DC. Prodr. xviii. 159, from Nepal, is a doubtful species.

ORDER LXVIII. PLATANEÆ.

Trees with flaking bark, alternate palmatifid leaves, caducous stipules and monoicous achlamydeous flowers collected in unisexual globose pendulous heads, intermingled with squamiform bracteoles. Male heads: consisting of numerous closely congested short stamens and minute somewhat fleshy paleaceous scales ; filaments very short ; anthers 2-celled, dehiscing longitudinally. Female heads: of numerous ovaries approximated in pairs immersed in scales similar to those of the male heads ; ovary 1-celled, with 1 (or 2) pendulous ovules ; style subulate-filiform, laterally stigmatose. Fruit a small 1-seeded nut, crowned by the persistent style, and surrounded by rigid setæ. Albumen 0, or very thin.

1. PLATANUS, Tourn.

(Only genus, the characters those of the Order.)

1. **P. orientalis,** Linn. ; Sibth. Fl. Græc. t. 945. *Oriental Plane.*—Vern. *Chinār* (the Persian name). Local names : *Būin, būna, boin,* Kashmir.

A large deciduous tree, with grey flexuose branches, woolly buds, young leaves and current year's shoots with soft, tawny, or ferruginous tomentum. Leaves glabrous, along nerves pubescent beneath, palminerved, deeply 3-5 lobed, lobes lanceolate, entire or dentate, 6-9 in. diam., petiole 3-5 in. long, pubescent, with a broad striated thickened base. On young luxuriant shoots the leaves often have a cuneate base, and the stipules are foliaceous and lobed. Fruit-heads globose, 1-1¼ in. diam., on short pedicels, on drooping axillary peduncles 4-6 in. long.

Cultivated in Afghanistan and the North-West Himalaya, particularly in the Kashmir valley (5300 ft.), east to the Bias and Sutlej, ascending to 8300 ft. in

Western Ladak. It grows well at Peshawar, and at the foot of the North-West Himalaya—*e. g.*, at Amb in the Hushiarpur district—and fairly well, without attaining any large size, at Amritsar and Lahore. Farther east it does not thrive, and in the Saharanpur garden trees do not live longer than a few years. The oriental Plane is indigenous in ravines and moist valleys of Greece, Macedonia, Armenia, and North Persia. Hehn (Culturpfl. 199) thinks that it was introduced from Asia Minor into Greece. Hardy in England. The foliage often gets reddish about October before it falls, the young leaves appear late in April, the flowers appear April, May, the fruit ripening soon afterwards and remaining long on the tree. Attains 75 ft. in Kashmir and Chamba, with a girth of 10-20 ft., the largest girth noted by Dr Stewart at Sirinagar being 28 ft. The branches spread wide; Stewart records two trees, one at Kishtwar (5500 ft.) on the Chenab, the other at Tikri in Chamba territory (same elevation), on a tributary of the Ravi, girth 19-20, extreme length of branches from trunk 37 and 44 ft. The Nasim Bāgh on the border of the great Kashmir lake is a large grove planted by Akhbar the Great soon after he had taken Kashmir in 1588. Originally the grove, which is about 800 by 400 yards, contained 1200 trees, a large proportion of which are still standing. In 1838, Vigne found the average girth to be 13 ft., and supposed their age to be 248 years. The largest, close to the water, averaged 20 ft. in girth. Of two trees 170 years old at Brein in Kashmir, Vigne found one 16′22″, the other 20′10″ in girth, and the largest Plane he had seen was under the Elbūrg mountains near Teheran 66 ft. in girth. Near Vostitza in the Morea, a tree over 40 ft. in girth is recorded. Many renowned large Plane trees in Asia Minor.

The bark is ⅛ in. thick, light or dark grey, peeling off in large thin scales. Wood yellowish white, somewhat resembling Beech-wood, with numerous broad medullary rays showing on a vertical section as glossy shining plates, with irregularly wavy outline. Pores numerous, very fine, uniformly distributed. Annual rings distinctly marked. No distinct heartwood. It is compact, fine-grained but not strong, and is not valued in Kashmir except to make boxes, trays, pencases, and similar articles which are lacquered and painted. In Afghanistan, where timber is scarce, it is said to be used for gun-carriages; in Persia and in the Levant furniture, doors, and window-frames are made of it. It takes a beautiful polish, and the mottled grain recommends it for cabinet-work.

P. occidentalis, Linn., of North America, and more commonly cultivated in Western Europe than the oriental Plane, differs by less deeply lobed leaves, which are pubescent when full-grown, and by slightly smaller fruit-heads.

Casuarina equisetifolia, Forster—Syn. *C. muricata*, Roxb. Fl. Ind. iii. 519—of the Order of *Casuarineæ*, is a large tree with leafless drooping branches, thickly set at the ends with numerous approximate slender articulate branchlets, which are deciduous and fulfil the function of leaves. Flowers monoicous, the male flowers monandrous, in terminal cylindric spikes, the female flowers in small pedicellate globose heads. Fruit a subglobose cone, formed of the enlarged and thickened woody bracts; seeds with a membranous wing. Indigenous on the coast of Chittagong and Burma, in the islands of the Indian Archipelago, North Australia, and Queensland. The *Beefwood* of Australia. Cultivated throughout India, thrives at Amballa. Wood hard, heavy, brown, darker near the centre, medullary rays very fine, very numerous. Polishes well, but cracks and warps. Yields excellent fuel; plantations of it for that purpose have been made near Madras.

The wood of *C. stricta*, Aiton; Benth. Fl. Austr. vi. 195—Syn. *C. quadrivalvis*, Labill.,—the *She Oak* of Tasmania, South Australia, Victoria, and New South Wales, and of several other Australian species, is marked by broad medullary rays, and is used for cabinet-work.

ORDER LXIX. EUPHORBIACEÆ.

Trees, shrubs, or herbs, often with acrid milky juice; leaves alternate or opposite, usually stipulate, rarely compound. Flowers always unisexual. Perianth very various; a calyx only or calyx and corolla, both present or both sometimes wanting. Stamens various. Ovary superior, 3-celled, rarely 2- or 1-celled, or with more than 3 cells; styles as many as carpels, free or connate, usually stigmatose on the ventral face; ovules 1 or 2 in each cell, pendulous. Fruit capsular, separating into its constituent carpels when ripe, or succulent and indehiscent. Seed oily, albuminous; embryo straight with a superior radicle and flat cotyledons in a fleshy albumen.—Royle Ill. 326.

This large Order (containing upwards of 3300 species) is distributed nearly over the entire globe. *Buxus* and *Sarcococca*, which are here included, are commonly classed under a separate Order, *Buxaceæ*, distinguished by styles distinct from the base and the absence of milky juice. The other genera here mentioned are classed under the following tribes by Joh. Müller in vol. xv. pt. ii. of De Candolle's Prodromus. They all belong to the series *Platylobeæ* with broad plane cotyledons.

Phyllantheæ.—Ovary-cells with 2 ovules; lobes of male calyx imbricate —*Bischoffia*, *Antidesma*, *Putranjiva*, *Phyllanthus*, *Breynia*, *Melanthesopsis*, *Securinega*, *Andrachne.*

Bridelieæ.—Ovary-cells with 2 ovules; lobes of male calyx valvate—*Bridelia*, *Lebidieropsis*, *Cleistanthus.*

Crotoneæ.—Ovary-cells with 1 ovule; lobes of male calyx imbricate; stamens inflexed in bud—*Croton.*

Acalypheæ.—Ovary-cells with 1 ovule; lobes of male calyx valvate; stamens erect in bud—*Trewia*, *Mallotus*, *Homonoya*, *Ricinus*, *Hevea.*

Hippomaneæ.—Ovary-cells with 1 ovule; lobes of male calyx imbricate; stamens erect in bud—*Excœcaria*, *Jatropha*, *Givotia*, *Codiæum.*

Euphorbieæ.—Ovary-cells with 1 ovule; flowers involucrate, involucres calyciform, enclosing male and female flowers—*Euphorbia.*

Flower-heads resembling single flowers, consisting of a calyx-like involucre, including several male flowers (single stamens) and 1 central female flower (a single pedicellate pistil) . . . . 1. EUPHORBIA.
Male and female flowers distinct, not united in heads.
  Flowers monoicous or dioicous, in spikes racemes or panicles; ovary-cells 1-ovulate.
    Male flowers with 5 petals alternating with calyx-segments; flowers monoicous . . . . . . 2. CROTON.
    Petals wanting; stamens free, or only connate at the base.
      Calyx-segments 3-4, imbricate; stamens 3-4; flowers usually monoicous; male flowers in bracteate spicate clusters . . . . 3. EXCŒCARIA.
      Calyx-segments 5, valvate; stamens numerous; male flowers in simple racemes or spikes.
        Leaves opposite; flowers dioicous; fruit a fleshy drupe, not dehiscent . . . . . . 4. TREWIA.
        Leaves alternate; flowers monoicous; fruit a dehiscent capsule . . . . 5. MALLOTUS.
    Petals wanting; filaments connate into a many-branched central column . . . . 6. HOMONOYA.

Flowers dioicous, in panicles, catkins, or spikes; ovary-cells 2-ovulate.
Leaves compound; flowers in axillary panicles . . 7. BISCHOFFIA.
Leaves simple; male flowers in catkins; female flowers in axillary spikes . . . . 8. ANTIDESMA.
Flowers usually monoicous, in axillary clusters, fascicles, or solitary.
Leaves opposite; styles free and distinct . . . 9. BUXUS.
Leaves alternate, usually distichous; styles more or less united.
Calyx 5-lobed, valvate; petals 5.
Ovary 2-celled; styles 2; fruit a berry. . . 10. BRIEDELIA.
Ovary 3-celled; styles 3; fruit a dehiscent capsule.
Main lateral nerves prominent; petals obovate . 11. LEBIDIEROPSIS.
Lateral nerves indistinct; petals minute . . 12. CLEISTANTHUS.
Calyx 4-6-lobed, imbricate; petals wanting.
Stamens central; no rudiment of ovary.
Fruit a drupe with a hard rugose 1-seeded putamen 13. PUTRANJIVA.
Fruit dehiscent, dry or fleshy.
Calyx deep 5-6-cleft; segments not appendiculate . . . . 14. PHYLLANTHUS.
Calyx turbinate, 6-lobed; the lobes appendiculate at the back (berries red) . . 15. BREYNIA.
Stamens surrounding a rudimentary ovary, as long as stamens.
Small trees; fruit fasciculate, short-pedunculate; white dehiscent berries . . . . . 16. SECURINEGA.
Small shrubs or undershrubs; fruit capsular, solitary, axillary, on long slender peduncles 17. ANDRACHNE.

African Oak or *Teak*, a heavy wood (60-70 lb. per cub. ft.), stronger than English Oak or Indian Teak, which does not affect iron in contact with it, but is not otherwise as durable as Teak, is employed for certain purposes in ship-building. It is exported from the west coast of tropical Africa, and the tree yielding it is as yet imperfectly known. In Hooker's Journal of Botany, ii. (1850) t. 6, it is described as *Oldfieldia africana*, Benth. & Hook., with digitate leaves and a 3-celled loculicidal capsule, and is doubtfully classed under *Euphorbiaceæ:* Joh. Müller (Prodr. xv. ii. 1259) refers it to *Sapindaceæ*.

1. EUPHORBIA, Linn.

Herbs, shrubs, or small soft-wooded trees with fleshy branches abounding in milky juice. Leaves of the stem alternate, without stipules, or with stipular spines, in some species opposite and stipulate, those of the flowering branches opposite. Flower-heads resembling single flowers, consisting of a calyx-like cup-shaped involucre, with 4-5 teeth, alternating with as many large horizontal glands, which encloses 10-15 male and 1 central female flower. Male fl.: one 2-celled, often didymous anther on an articulated filament. Female fl.: a stipitate, 3-celled ovary, protruding from the involucre, style 3-cleft, the branches 2-lobed. Numerous fimbriate bracts often between the male flowers, the outer ones sometimes adnate to the involucre. Capsule separating into three 2-valved cocci.

Besides numerous annual and perennial herbs, this genus comprises in India a number of shrubs or small trees with fleshy stems, which should be noticed here. In the following the characters are given by which the species are commonly distinguished. They demand, however, farther study on the spot, and it is not impossible that their number will eventually be reduced. The geographical distribution of some of them in India is as yet imperfectly known.

Armed with pairs of stipular spines.	
Branches with 5 sharp prominent angles	1. *E. Royleana.*
Branches round, with 5 more or less spirally-twisted ribs .	2. *E. neriifolia.*
Branches round, not ribbed or angled	3. *E. Nivulia.*
Unarmed; stems and branches cylindric; leaves linear-lanceolate	4. *E. Tirucalli.*

1. **E. Royleana**, Boissier in DC. Prodr. xv. ii. 83.—Syn. *E. pentagona*, Royle Ill. t. 82 (not of Haworth).—Vern. *Thor*, North India. Local names in Panjab: *Sūli*, Jhelam; *Chūla*, Chenab; *Chūn*, Ravi; *Chū, chiū, chūnga, sūrs*, Bias; *Sūra, tsūi*, Sutlej; *Sihūnd*, Kamaon.

Branches angular, generally pentagonous, angles sharp, undulate. Spines twin, short. Flower-heads yellow, in sessile clusters.

Common on the dry hills of the Siwalik tract from Kamaon to the Jhelam, entering some distance into the valleys, and ascending to 4000, occasionally to 6000 ft. According to Aitchison (Cat. 132), not on Mount Tilla or the Salt range, but Stewart (Pb. Pl. 194), gives *Tordanda, danda, tor* as the Salt range names. This is probably the species on the dry hills near Jeypur, which furnishes a great part of the fuel for that city. Attains 15-16 ft.; the stems have generally a girth of 2-3, but sometimes of 5-6 ft. In the outer hills it is often planted as a hedge; grows readily from cuttings, even in the driest soil. The wood is soft and useless. It is cultivated at places near the foot of the hills—*e. g.*, at Sealkot, Jalandar, but does not thrive far out in the Panjab plains.

Besides *E. Royleana*, the following Indian species with angular branches have been described:—

a. E. antiquorum, Linn.; Roxb. Fl. Ind. ii. 468; Wight Ic. t. 897.—Sans. *Sihūnda.* Vern. *Nara sij, tekata sij*, Beng.; *Tidhāra, tidhāra sehnd*, Hindi. Branches with 3, rarely 5 angles, leaves minute or wanting. Peduncles solitary or in pairs, a little above the spines, usually with 3 flower-heads, the centre head fertile. Common on dry hills in Bengal and the peninsula. Wood white, light, soft, but even-grained.

b. E. Cattimandoo, Elliot in Wight Ic. t. 1993, *Katti mandu* (knife medicine), Tel. Branches with 5 sharp prominent angles which are deeply sinuate between the nodes, the furrows between the angles forming deep channels. The leaves are cuneate, mucronate. This species grows in great abundance in the Vizagapatam district; it flowers from March to the beginning of June, after the leaves fall; the fresh leaves appear in July and August. Attains 8-14 ft., with a stem 3-4 ft. high. The milk flows freely when branches are cut; it is collected, boiled, formed into cakes or cylinders, and used as a cement for fixing knives into handles and for similar purposes. When dry it is resinous and brittle, and its properties are essentially different from those of Caoutchouc or Gutta-Percha.

c. E. trigona, Roxb. Fl. Ind. ii. 468; Wight Ic. t. 1863. Branches with 3 prominent angles, deeply sinuate between the nodes, and hollowed out between the angles; 2, sometimes 4 stout stipular spines, and large, deciduous, shining, cuneate leaves at the ends of branches. Peduncles from the sinuses on the angles of the branches, short, thick, generally with 3 flower-heads, the centre one sessile, with male flowers only, the lateral ones pedicelled, fertile. Fl. Feb.-April, after the leaves have fallen. Brought from the Molucca Islands to Calcutta in 1798 (Roxb.) Rocky arid hills near Coimbatur (Wight), Andamans (S. Kurz).

d. E. tortilis, Rottler; Wight Ic. t. 898. Branches with 3 prominent angles, spirally twisted. Flower-heads numerous, fasciculate on the angles above the nodes. Dry hills near Madras and of the Coromandel coast.

2. **E. neriifolia,** Linn. (not Roxb.); DC. Plantes Grasses, t. 46.—Syn. *E. Ligularia,* Roxb. l. c. 465. Vern. *Thor,* Bombay; *Gāngīchū,* Pb.; *Munsa sij,* Beng.

A small tree. Stem cylindric, branches terete, but with 5, more or less spirally twisted ribs. Spines twin. Leaves near the ends of branches, cuneate or oblanceolate, 6-12 in. long, narrowed into petiole. Peduncles solitary, in the sinus between the nodes with dichotomous cymes of 3-15 flower-heads.

Common in the Konkan and Dekkan (Dalzell Bomb. Fl. 226). Cultivated near villages in most parts of India, also in the Siwalik tract of the N.W. Himalaya. Fl. Feb.-March. The leaves fall in autumn and appear again after flowering, in March or April. Attains 20 ft., stem often 12 in. diam. The milk is employed externally in native medicine, and the root, mixed with black pepper, for the cure of snake-bites.

3. **E. Nivulia,** Hamilton in Trans. Linn. Soc. xiv. 286; Wight Ic. t. 1862.—Syn. *E. neriifolia,* Roxb. l. c. 467. Vern. *Sij,* Beng.

A shrub, stems and branches round, without ribs or angles; branchlets in whorls of four. Spines in pairs, spirally arranged. Leaves cuneate or obovate, sessile, fleshy, mucronate, 4-6 in. long. Peduncles 3-flowered, from the nodes.

Dry hills Garhwal, Peninsula, Guzerat, and Sindh (Dalzell Bomb. Fl. 226). Leafless Jan.-March. Fl. March; fr. April-May. Grown in hedges.

4. **E. Tirucalli,** Linn.; Roxb. l. c. 470.—*Milk-bush.* Vern. *Lanka sij,* Beng.; *Sĕhnd,* Hindi; *Tiru kalli,* Malayalim.

A small tree or shrub, with round stems and smooth green, terete branches, not angled and unarmed. Leaves linear-lanceolate. Flower-heads numerous, in clusters at the ends and in the forks of the branches.

Indigenous in Africa, introduced into India, and now naturalised in the Peninsula and Bengal, cultivated in North-West India as far as Hushiarpur. Often planted in hedges. Fl. during the rains. Attains 20 ft.; the wood is strong, and used for building. Milk extremely acrid and vesicant.

Euphorbia pulcherrima, Willd.—Syn. *Poinsettia pulcherrima,* Graham; Bot. Mag. t. 3493, is a well-known garden shrub, with large crimson floral leaves. Indigenous in Mexico and Central America, and now commonly grown in Indian gardens as far north as Saharunpur.

2. CROTON, Linn.

Trees, shrubs or herbs, with alternate, petiolate leaves, often with scales or stellate hairs. Flowers usually monoicous, in terminal spike-like racemes, the female flowers at the base of the spike. Calyx 5-parted. Petals, in the male flowers, alternating with calyx-segments, in the female flowers often wanting. Disc of 5 glands, alternating with petals. Stamens central, numerous, filaments free, with the anthers inflected in bud. Ovary 2-4-, generally 3-celled, 1 ovule in each cell. Capsule dividing into 3, 2-valved cocci.

1. **C. oblongifolius,*** Roxb. Fl. Ind. iii. 685; DC. Prodr. xv. ii. 573. —Syn. *C. lævigatus*, Wall. Vern. *Arjunna*, Oudh; *Bara gach*, Bengal.

A middle-sized tree; extremities, inflorescence, calyx and ovary with small adpressed circular silvery scales. Leaves pale green, glabrous, oblong-lanceolate, dentate, penniveined, blade 5-10, petiole 1-2 in. long, stipules small, caducous. Flowers pale yellowish-green, on short pedicels, in the axils of minute bracts, in long terminal racemes, female and male flowers generally mixed; the latter more numerous. Calyx of 5 ovate segments. Petals white, woolly, as long as calyx-segments. Stamens 12. Fruit subglobose, indistinctly 3-lobed, 6-furrowed, ½ in. diam.

Common in the central and eastern part of the Gonda district, Oudh, spreading in belts through miles of forests. Behar, Bengal, Burma, Ceylon. The leaves are shed early in March, and turn red before falling, the young foliage appears soon afterwards, forming a pleasant contrast with the leafless forest around. Fl. April (Oudh), Nov.-Feb. (Burma). Seed ripens April-May. Attains 30 ft., and a girth of about 3 ft. Trunk erect, short, often irregularly furrowed, bark 1 in. thick, grey or brownish, inner bark red, coarsely fibrous. Wood white, close-grained, moderately hard, cracks in seasoning, no distinct heartwood. Bark leaves and fruit are used externally in native medicine.

C. Tiglium, Linn.; Roxb. Fl. Ind. iii. 682; Hayne Arzneigew. xiv. t. 3—*the Purging Croton;* Vern. *Jepāl, jamal gota*—is a small tree, glabrous, without scales, pedicels and ovary hairy. Leaves ovate, acuminate, serrate, with 3 basal nerves. Female fl. without petals. Capsule obtusely 3-cornered, ¾ in. long. The seeds are a powerful drastic purgative, and the oil is a valuable medicine (Pharm. Ind. 200). Bengal, South India, Burma, Ceylon, Indian Archipelago.

3. **EXCŒCARIA,** Linn.

Trees or shrubs, mostly glabrous, with alternate, rarely opposite, stipulate and petiolate leaves. Flowers monoicous, rarely dioicous, in terminal or axillary spikes; female flowers generally few, at the base of the spike, sometimes in separate spikes. Male flowers fasciculate, sessile or short-pedicellate, the fascicles bracteate, generally with bracteoles between the flowers. Calyx membranous, sometimes cup-shaped, generally of 2-3 segments or distinct sepals. No disc or petals. Stamens 2-3, filaments generally free, central, anthers didymous, dehiscing longitudinally. Ovary 2-3-celled, 1 ovule in each cell; styles as many as cells more or less connate at the base, stigmatose inside. Fruit a dry capsule or a berry, 2-3-celled, and always opening loculicidally in 3 valves.

A few female flowers at the base of the male spikes.
  Calyx of male flowers 3-fid, segments ovate; leaves rhomboid, long-petiolate entire . . . . 1. *E. sebifera.*
  Calyx of male flowers of 3 distinct linear segments; leaves elliptic-lanceolate, short-petiolate, serrate . . . 2. *E. acerifolia.*

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* Linnæus made Croton neuter, but Κρότων is masculine.

Male and female flowers in distinct spikes; calyx of male flowers of 2 broad, nearly distinct, thinly membranous segments; leaves large, oblong-lanceolate, dentate . . . . . 3. *E. insignis.*

1. **E. sebifera,** Müll. Arg.; DC. Prodr. xv. ii. 1210.—Syn. *Croton sebiferum*, Linn. *Stillingia sebifera*, A. de Juss.; Benth. Fl. Hongk. 302. *Sapium sebiferum*, Roxb. Fl. Ind. iii. 693. The *Chinese Tallow-tree.*

A small and glabrous tree. Leaves rhomboid or broad-ovate, entire, long-acuminate, blade 2-3, petiole 1-2 in. long, main lateral nerves 6-8 pair. Flowers greenish-yellow, in terminal drooping spikes 3-5 in. long, with a few female flowers at the base of the spike. Male flowers unequally pedicellate, in bracteate fascicles, 2-3-androus; calyx 3-fid. Female flowers solitary, short-pedicellate; calyx 4-partite. Capsule dry, smooth, subglobose, acute, ½ in. long. Seeds 3, enclosed in a thick layer of white fatty substance, attached to a central column which splits into 3 slender divisions.

Indigenous and cultivated in China and Japan. Introduced into Bengal and the sub-Himalayan tract of North-West India, where it thrives luxuriantly. Fl. June; the seeds ripen in autumn. Bark grey. In Japan and China the tallow is separated from the seeds by boiling in water; it is harder than animal tallow, and candles are made of it, which are coloured and generally used in Chinese temples. The seeds (after the tallow is removed) yield oil, and a black dye is made of the leaves. The wood is light and soft but even-grained.

E. baccata, Müll. Arg.—Syn. *Sapium baccatum*, Roxb. l. c. 694; *S. populifolium*, Wight Ic. t. 1950—is a large glabrous tree with ovate, entire, acuminate leaves, main lateral nerves 8-12 pair, flowers in paniculate spikes, male and female flowers generally on distinct branches (dioicous, Roxb.) Male flowers in bracteate fascicles, calyx 4-dentate. Fruit a 2-celled more or less 2-lobed berry, purple when ripe. East Bengal (*Billa*, Silhet), Burma (*Linhlūn*), Indian Archipelago.

2. **E. acerifolia,** F. Didrichs.—Syn. *Stillingia Himalayensis*, Klotzsch in Reise des Prinzen Waldemar, t. 21. Vern. *Pūtkia, phūtkia*, N.W.P.

A large glabrous milky shrub, with deep-green foliage. Leaves membranous, elliptic-lanceolate, serrate, short-petiolate, main lateral nerves prominent, 6-8 pair. Flowers monoicous, a few female flowers at the base of the spikes. Male flowers sessile, in bracteate fascicles; calyx of 3, sometimes 2 or 4, almost distinct linear segments. Stamens 3. Fruit a dry coriaceous, 2-3-lobed capsule, ⅜ in. across.

Kasia hills, Nepal, Kamaon, abundant in a few places. Fl. May; fr. Oct.-Nov. Attains 20 ft., bark brownish-grey, longitudinally wrinkled. The root when crushed has a disagreeable smell, and is used occasionally as a carthartic.

Nearly allied is *E. indica*, Müll. Arg.—Syn. *Sapium indicum*, Roxb. l. c. 692; Wight Ic. t. 1950 (*Hurūa*, Beng.)—a small tree with coriaceous oblong-lanceolate, serrulate leaves on short petioles. Spikes solitary, with a few female flowers at the base. Male flowers in short, bracteolate spikelets; calyx 3-cleft to near the base, segments broad-ovate. Fruit a large globose 3-seeded capsule, with thick woody valves. Bengal, Burma (evergreen forests), Ceylon. The seeds are used to intoxicate fish.

3. **E. insignis**, Müll. Arg.—Syn. *Falconeria insignis* and *F. Wallichiana*, Royle Ill. t. 84^{a} *F. malabarica*, Wight Ic. t. 1866. Vern. *Dūdla*, *bilodar*, *biloja*, *karālla*, Pb.; *Khinna*, *khīna*, *līenda*, *lendwa*, *līnda*, N.W.P.

A middle-sized or large, glabrous, milky, deciduous tree, with thick branches and bright-green foliage. Leaves oblong-lanceolate, acuminate, dentate, blade 6-15 in., petiole thick, 1-2 in. long, with 2 stipitate circular glands at the apex, main lateral nerves arcuate, 15-20 pair. Flowers in long, somewhat fleshy, naked terminal spikes, male and female flowers on distinct branches (dioicous, Wight). Male flowers shortly pedicellate, in circular fascicles, the inner flowers, which expand first, falling off from the persistent base of their pedicels. Calyx of 2 broad, nearly distinct thin membranous segments. Fruit a spike of numerous, subsessile, ovoid capsules, ¼ in. long, on a thick rachis, the capsules 2-3-celled, fleshy at first, dry and irregularly dehiscent when ripe.

Sub-Himalayan tract and warm valleys of the outer hills, extending west to the Bias, and ascending to 4000 ft. (in Kamaon to 5500 ft.), Chittagong, Burma, Karnūl hills (Bedd.) and Western Ghats, known as far north as Nassik. Leafless during the dry season; the young foliage appears in May. Fl. Jan.-March, while the tree is bare; fr. May, June. Attains 50-60 ft., trunk 12 ft. long and 3 ft. girth. At 5000 ft. in Kamaon a stunted tree, 10-12 ft. high, and not rarely killed to the ground by frost. Bark grey, smooth, shining, with large broad longitudinal wrinkles. All parts of the tree are full of an acrid milk, said to be poisonous. Wood whitish, very soft, spongy and brittle, used to make the cylinders of native drums.

E. Agallocha, Willd.; Roxb. l. c. 756, is a small, glabrous, crooked, and stunted milky tree in the Sundarbans, on the sea-coast of Bengal, the peninsula, the Indian Archipelago, and North Australia (*Geria*, Beng.), with coriaceous, elliptic-lanceolate, slightly crenate leaves, lateral nerves indistinct, and dioicous, fragrant flowers in axillary spikes. Male flowers fasciculate, calyx of 4 linear sepals, anthers 3, on long exserted filaments. Capsule 3-lobed, coriaceous, ⅓ in. across. The white milk is acrid and poisonous. The Agallochum wood is not the produce of this tree, but of *Aquilaria Agallocha*, Linn. (p. 387).

To the tribe of *Hippomaneæ* belong also :—

Jatropha Curcas, Linn.; Roxb. Fl. Ind. iii. 686, is a glabrous soft-wooded shrub, with long-petiolate cordate, angular leaves, and yellow flowers in axillary pedunculate paniculate cymes. Calyx-segments 5, imbricate in bud. Petals twice the length of calyx-segments. Disc of 5 glands alternating with petals. Stamens 10, the 5 inner connate into a central column, the 5 outer free. Ovary 3-celled, 1 ovule in each cell. Capsule ovoid, 1 in. long, 3-celled, 3-valved with 3 dark brown or black seeds. Indigenous in tropical America; cultivated in most tropical countries and naturalised in India. Common at the foot of the hills in Oudh and Kamaon—Vern. *Safed ind* (Madden). The oil of the seed (*English Physic Nut*) is a strong purgative (Pharm. Ind. 203).

Givotia rottleriformis, Griff.; Wight Ic. t. 1889; Bedd. Fl. Sylv. t. 285, a middle-sized tree, young shoots, inflorescence, and under side of leaves densely grey-tomentose with stellate hairs, leaves alternate, broad-ovate or rotundate with cordate base, crenate. Flowers dioicous, in axillary slender panicles, calyx nearly to the base 5-cleft, petals alternating with the sepals in both male and female flowers. Fruit fleshy indehiscent, 1-seeded. Mysore and Dekkan. Wood soft and light, used to carve figures, toys, and the like, which are lacquered and painted.

Codiæum variegatum, Blume—Syn. *C. pictum*, Hook. Bot. Mag. t. 3051; *Croton variegatum*, Linn.—a shrub with glabrous, shining, entire, oblong leaves with prominent lateral nerves, often variegated, and cultivated on that account in gardens of tropical and sub-tropical India. Male flowers with petals; fruit a dehiscent capsule. Indigenous in the Indian Archipelago.

4. TREWIA, Linn.

A deciduous tree, with opposite long-petiolate leaves. Flowers dioicous, the male in long drooping racemes, the female in few-flowered racemes. Calyx-segments 3-4, in the male flowers equal and valvate, in the female flowers unequal and imbricate. Petals none. Stamens central, numerous, filaments free, anthers dehiscing longitudinally, connective not prolonged beyond the anthers. Ovary 3-4-celled, 1 ovule in each cell; style 1, short, with 3-4 long filiform very papillose stigmas. Fruit a fleshy drupe, not dehiscing, with a hard bony, 3-4-celled endocarp. Seeds without arillus, flat cotyledons and superior radicle in a fleshy albumen.

1. **T. nudiflora**, Linn.; Roxb. Fl. Ind. iii. 837; Wight Ic. t. 1870, 1871; Bedd. Fl. Sylv. t. 281.—Syn. *F. macrostachya*, Klotzsch Reise des Prinzen Waldemar, t. 23. Vern. *Tumri*, *khamara*, Kamaon; *Bhillaur*, *bhillaura*, Oudh; *Pitali*, Beng.; *Petari*, Bombay.

Youngest parts with caducous tomentum, ovary soft-tomentose, otherwise glabrous. Leaves cordate or broad-ovate, glabrous, with 5 basal nerves, the midrib penniveined, blade 6-9, petiole 3-4 in. long. Flowers greenish yellow; male racemes 4-9 in. long; flowers on short slender pedicels, in bracteate fascicles of 3-4; female flowers on longer pedicels, solitary or in few-flowered racemes. Calyx-segments of female flowers thinly membranous, caducous. Stigma 1 in. long. Drupe depressed-globose, mucronate, 1 in. diam.

Sub-Himalayan tract, west to the Jumna, and ascending to 3000 ft. Common in the Dehra Doon, the Kamaon Bhabar, and in Oudh. Banks of the Nerbudda between Jubbulpur and Mandla. Bengal, South India, Burma, Ceylon and Java. Banks of rivers, in swamps and damp places. The leaves are shed Jan.-Feb., and the young foliage comes in March, April. Fl. Nov.-April. Attains 60 ft. with a straight trunk, 30 ft. to the first branch, and 6-7 ft. girth. These are the dimensions of male trees in the Oudh forests. Female trees are smaller, with shorter trunks and more straggling branches (R.T.) The leaves somewhat resemble those of *Gmelina arborea* and *Thespesia populnea*. Bark ½ in. thick, smooth, whitish, greenish, or greenish-brown, inner bark greenish-yellow, fibrous. Wood whitish, straight-grained, moderately tough, no distinct heartwood. Used to make the cylinders of native drums, and for agricultural implements.

5. MALLOTUS, Loureiro.

Shrubs or trees with alternate (rarely opposite) long-petiolate stipulate leaves. Flowers usually dioicous, in racemes or spikes. Calyx 2-5-cleft, valvate in the bud. No disc or petals. Stamens numerous, central on a raised receptacle, filaments free or cohering at the base, anther-cells distinct, longitudinally adnate. Ovary 2-5-, generally 3-celled, 1 ovule in each cell; styles as many as cells, simple, recurved, plumose along the inner side. Capsule tomentose or muricate, 2-5-celled and 2-5-valved.

1. **M. philippinensis**, Müll. Arg.; Bedd. Fl. Sylv. t. 289. Syn. *Rottlera tinctoria*, Roxb. Cor. Pl. t. 168; Fl. Ind. iii. 827. Sans. *Punnāga, kesara.* Vern. *Kamela, kamīla, kamal, kambal, kembal, kūmila*, North India; *Rūen, riūna, roli*, Kamaon; *Rohni*, Oudh; *Rāuni rori*, C.P.; *Shendri*, Bombay; *Taw thidin*, Burm.

A large shrub or small tree, branchlets, inflorescence and under side of leaves hoary. Leaves alternate, ovate or ovate-lanceolate, entire, glabrous above, hoary and with minute red glands beneath, blade 4-9 in., petiole 2-3 in. long, 2 depressed glands at the base of leaf, 3 basal nerves, midrib penniveined, the nerves joined by numerous parallel veins at right angles to the midrib. Flowers white and yellow, dioicous, subsessile, in axillary and terminal paniculate bracteate spikes. Ovary tomentose, 3-celled, styles 3, ¼ in. long, thickly papillose. Fruit a 3-lobed, 3-celled, 3-valved capsule, ⅓ in. diam., dehiscing loculicidally, and densely covered with a bright red powder, consisting of minute stellate hairs and fine grains of a red resinous substance soluble in alcohol and ether.

Common in the sub-Himalayan tract, extending nearly to the Indus, and ascending to 4500 ft. Common in Oudh, Bengal, Central- South-India and Burma. Ceylon, the Indian Archipelago, Formosa and Loo Choo islands, and North Australia. Fl. Nov.-Jan.; the fruit ripens in the hot season. Never leafless; the leaves are renewed Nov.-Dec. (Oudh, R.T.) Attains 20-30 ft., generally with branches from the base, sometimes with an erect but short, generally fluted and irregularly-shaped trunk, 3-4 ft. girth. Bark ¼ in. thick, inner substance compact, fibrous, reddish-brown, visible at the bottom of numerous, shallow reticulate longitudinal wrinkles, surface between the wrinkles light- or dark-grey, at times nearly black. Wood light-brown, only used for fuel. The bark is used for tanning; leaves and fruit are applied externally, with honey, against the bite of poisonous animals. The most important produce, however, is the powder which covers the ripe fruit (*Kamela, Kamala*). It is used for dyeing silk, also as a purgative and anthelmintic (Pharm. Ind. 202). The seeds are sold in the Panjab bazaars as a medicine under the name of *baobrang*, and at Almora they are said to be sold as *bebarang* (*Embelia Ribes*, p. 284).

M. albus, Müll. Arg.—Syn. *Rottlera tetracocca*, Roxb. Fl. Ind. iii. 826; *R. mappoides*, Dalz. Bomb. Fl. 230—is a large tree with large cordate, often subpeltate alternate leaves, branches and under side of leaves tawny with dense stellate tomentum, ovaries 4-celled, capsules generally 4-celled, 4-valved, tomentose, and covered all over with soft hairy appendices.—Bengal, Indian Archipelago, Western India, perhaps in Nimar.

M. repandus, Müll. Arg.—Syn. *Rottlera dicocca*, Roxb. Fl. Ind. iii. 829, is a weak subscandent shrub, tawny tomentose, with cordate leaves 2-4 in. long, ovaries 2-celled, styles 2, capsules 2-lobed, 2-valved, hairy. Bengal, Indian Archipelago, South India.

6. HOMONOYA, Loureiro.

Shrubs with alternate leaves, stipules caducous. Flowers generally dioicous, the male flowers in spikes, the female flowers in spiciform racemes. Calyx of the male flowers of 3, of the female flowers of 5 nearly distinct segments, those of the former valvate, of the latter imbricate in bud. Disc and petals none. Stamens polyadelphous, anthers numerous, 1-celled, adnate to a many-branched central column. Ovary mostly 3-celled, 1 ovule in each cell. Capsule small, 3-seeded.

1. **H. riparia**, Lour.—Syn. *Adelia neriifolia*, Roth ; Roxb. Fl. Ind. iii. 849 ; Wight Ic. t. 1868. Vern. *Taniki*, Tel. *Yay-tagyiben*, Burm.

A small shrub, somewhat resembling a willow, branches hairy. Leaves linear-lanceolate, 4-8 in. long, penniveined, under side with circular scales and scattered hairs. Flowers dioicous, in axillary bracteate spikes about half the length of leaves. Anthers and stigmas red. Capsule tomentose, 3-celled, 3-valved, 3-seeded.

Common in rocky river-beds of South and Central India. Attains 6-8 ft., and flowers Nov.-March.

H. retusa, Müll. Arg.—Syn. *Adelia retusa*, Wight Ic. t. 1869—has sessile obovate or oblanceolate dentate leaves, female flowers in short spikes, male flowers in axillary fascicles. River-beds in the Dekkan.

Ricinus communis, Linn. Roxb. Fl. Ind. iii. 689—Sans. *Eranda;* Vern. *Rand*, *arand*, *rendi*, *erendi*, *ind*, Hind. : Local n. *Aneru*, Chenab ; *Harnauli*, Salt range ; *Tirki*, the small kind in Guzerat ; *Haralu*, Canar.,—the well-known Castor Oil or Palma Christi plant, a soft-wooded tree, of short duration, which is often cultivated as an annual, *e. g.*, in Guzerat and Bengal, for its oil, is nearly allied to *Homonoya*, but differs, apart from the peltate palmately lobed leaves, by monoicous flowers, and a fleshy appendage on the seed near the funicle. The large prickly capsules consist of 3 subcylindrical lobes rounded at the ends, with 3 spotted seeds. Cultivated in the Mediterranean region, the United States, the West Indies, India, China, and the Indian Archipelago. Naturalised in the sub-Himalayan tract of the Panjab, indigenous in Arabia and North Africa. As a small tree, it is cultivated near villages in Bengal to feed the Arindi silk-worm (Roxb. in Trans. Linn. Soc. vii. 42). Regarding the cultivated varieties of the Castor Oil plant in India, see Hamilton in Trans. Linn. Soc. xiv. 248.

Para Rubber, the finest and most durable caoutchouc as yet known, is the produce of several species of *Hevea*, a South American genus, particularly of *H. braziliensis*, Müll. Arg.—Syn. *Siphonia brasiliensis*, Willd. ; Hayne Arzneigewächse, xiv. t. 5 ; Collins' Report on Caoutchouc, 1872, 1—a large evergreen tree, indigenous in the province of Para, and on the Orinoco river, with alternate, glabrous, ternate, long-petiolate leaves, leaflets entire, acuminate. Flowers monoicous, in large white-tomentose lateral panicles. Calyx campanulate, 5-lobed, petals none. Anthers adnate to a central column. Fruit a large 3-lobed, 3-valved capsule, having the appearance of 3 slightly connate cylinders, rounded at the ends, thick, woody-fibrous. Seeds 3 large, smooth, shining, spotted, with a thick brittle testa.

7. BISCHOFFIA, Blume.

Leaves trifoliate, stipules early caducous. Flowers dioicous or monoicous, in axillary panicles. Calyx of 5 valvate segments, those of the male flowers concave, enclosing the stamens at first, afterwards reflexed, those of the female flowers lanceolate. Petals none. Stamens 5, opposite the segments, and inserted round a raised circular central body (rudimentary ovary), filaments very short. Ovary 3-celled, 2 ovules in each cell, styles linear, entire. Fruit a globose drupe, enclosing 3 indehiscent 1-2-seeded cocci.

1. **B. javanica**, Blume.—Syn. *B. oblongifolia*, $D^{ne.}$ in Jacq. Voy. Bot. t. 154; *Andrachne trifoliata*, Roxb. Fl. Ind. iii. 728; *Microelus Rœperianus*, W. & A.; Wight Ic. t. 1880; *Stylodiscus trifoliatus*, Bennett; Dalz. Bomb. Fl. 235. Vern. *Kein*, Garhwal; *Korsa*, Kamaon; *Irum*, Oudh.

A large glabrous tree. Leaflets petiolulate, crenate, elliptic, acuminate, 4-6 in. long. Flowers pale-greenish yellow, on short pedicels, bracts lanceolate, deciduous.

Moist shady ravines in the sub-Himalayan forests of Kamaon and Garhwal. Common in the Gonda forests of Oudh, and in the Gorakhpur forests. Bengal, South India, Burma, Indian Archipelago, South China, Polynesia. The leaves are renewed in Feb. and March. Fl. March, April. The fruit ripens in April of the ensuing year. An exceedingly handsome tree, attaining 70 ft., and 7 ft. girth, with a shady oval crown. In dry places a stunted tree 15-20 ft. high. The foliage is deep green, and turns red before falling. Bark ½ in. thick, dark grey, brown or blackish, smooth or rough, with cracks, and exfoliating fibrous angular scales, inner bark reddish, fibrous. Wood pale red, fine- and close-grained, greyish or reddish brown, seasons well, is said to be durable. Used for furniture.

8. **ANTIDESMA**, Burm.

Trees or shrubs with alternate, entire, stipulate, penniveined leaves. Flowers dioicous, numerous, small, the male flowers in deciduous spikes, the female flowers in spikes or spike-like racemes. Calyx of 3-5 imbricate lobes. Petals wanting. Stamens opposite to calyx-lobes, inserted round a rudimentary ovary, filaments free. Disc of distinct glands, alternating with filaments and calyx-segments. Ovary 1-celled, with 2 pendulous ovules, styles 3 or 4, short, united at the base. Fruit an indehiscent, generally 1-seeded drupe.

Soft-tomentose; flowers sessile; calyx deeply 5-cleft; stamens 5	1. *A. Ghæsembilla*.
Extremities with scattered rust-coloured hairs; flowers pedicellate; calyx cup-shaped; stamens 2-3. . . .	2. *A. diandrum*.

1. **A. Ghæsembilla**,* Gærtn.; Benth. Fl. Austr. vi. 85; Bedd. Fl. Sylv. Man. 200.—Syn. *A. paniculatum*, Roxb. Fl. Ind. iii. 770; Wight Ic. t. 820. *A. pubescens*, Roxb. Cor. Pl. t. 167; Wight Ic. t. 821. Vern. *Byaitsin*, Burm.

A small deciduous ramous tree with light grey bark, branchlets, young leaves and inflorescence soft-tomentose. Leaves oval or obovate, 2-3 in. long, short-petiolate, main lateral nerves 4-6 pair, stipules subulate, as long as petiole. Flowers greenish yellow, male spikes 1-2 in. long, female spikes somewhat shorter, both in short terminal panicles and very tomentose, female flowers sessile. Calyx deeply 5-cleft, stamens 5. Drupes small, dark purple when ripe, pulp agreeably acid.

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* It appears doubtful what Gærtner included under *A. Ghæsembilla*. See Tulasne Ann. Sc. Nat. ser. iii. xv. 238. I follow Müller, Bentham, and Beddome in identifying it with this sp.

Nepal, Oudh forests (common), Bengal, South India, Ceylon, Burma (in the Eng forest of *Dipterocarpus tuberculatus*), Indian Archipelago, Hong-Kong. Fl. May, June. Fruit eaten.

2. **A. diandrum**, Tulasne.—Syn. *Stilago diandra*, Roxb. Cor. Pl. t. 166; Fl. Ind. iii. 759. Vern. *Amli*, *sarshoti*, *sarsheti*, Garhwal; *Dhakki*, *Gūr mussureya*, *Ban mūssureya*, Oudh, Gorakhpur.

A small deciduous tree, branchlets, petioles, and under side of leaves along midrib, with scattered rust-coloured hairs, otherwise glabrous. Leaves lanceolate or ovate-lanceolate, shortly petiolate, 2-4 in. long, glabrous, shining, stipules lanceolate. Flowers greenish-yellow, male and female on short pedicels, in the axils of subulate bracteoles, spikes (racemes) terminal, solitary, or 2-3 together, slender; male spikes 2-3 in. long, female spikes shorter. Calyx cup-shaped, 5-dentate. Stamens 2-3. Drupes small, of a pleasant acid taste.

Sāl forests of Garhwal, Kamaon, and Oudh. Behar, Bengal, South India, Java. Fl. May, June; fr. Dec.-Jan. The leaves turn brick-red before falling. Bark thin, smooth, whitish, scooped, inner bark pale red, fibrous. Trunk often channelled. Wood pinkish white, hard, and close-grained. The leaves are acid, and made into preserve (chutney); the fruit is eaten.

9. **BUXUS**, Tournefort.

Evergreen shrubs or undershrubs, with 4-sided branchlets and opposite, exstipulate leaves. Flowers monoicous, in axillary clusters. Calyx, of male fl. deeply 4-cleft, the segments opposite in pairs, of female fl. deeply 6-cleft, the segments in two circles of 3 each. Stamens 4, opposite the calyx-segments, inserted around a 4-sided rudimentary ovary. Ovary 3-celled, 3-cornered, with a flat top, the corners terminating in thick short styles, which alternate with the 3 inner calyx-segments. Capsule coriaceous, loculicidally 3-valved, each valve ending in 2 horns, being the halves of 2 of the styles, dissepiments attached to the valves. Seeds 3-6, trigonous.

1. **B. sempervirens**, Linn.; Hook. Stud. Fl. 330.—Syn. *B. Wallichiana*, Baillon; DC. Prodr. xvi. i. 18. *Box. Buchsbaum*, Germ.; *Buis*, Fr.; *Bosso*, It. Vern. *Shanda laghūne* (*barren Daphne*), Afg.; *Chikri*, Kashmir; *Pappar*, *papri*, *pāprang*, *shamshād*, *shumaj*, Pb.

A shrub, or small tree, extremities and petioles hairy. Leaves evergreen, coriaceous, glabrous, shining, varying in shape from linear-lanceolate to ovate, 1-3 in. long, narrowed into a short petiole, the tissue of the leaf consisting of two distinct strata, cohering at the edge, the upper stratum containing midrib, nerves, and veins. Flowers sessile, yellowish, with a powerful, unpleasant smell (Himalayan tree), in short, sessile, axillary heads or spikes, the terminal flower generally female, surrounded by numerous male flowers. Styles (in the Himalayan specimens) half the length of ovary, shorter in the European specimens.

Trans-Indus on the east side of the Suliman range (3000-4500 ft.) Salt range, common here and there in the N.W. Himalaya between 4000 and 8000 ft. (*e. g.*, in Khagan; on the Ruttun Pīr and near Pūnch in Kashmir; opposite Chergaon on the left bank of the Sutlej in Kunawar, &c. Also in Bhutan, at about 6000-7000 ft. A widely spread tree, Central and South Europe, North and West Asia. China and Japan.

Fl. March-May. The fruit ripens Aug.-Oct., the open empty capsules remaining on the tree a long time. Gregarious, attains 15-16 ft., with a short, erect, straight trunk 20-30 in. girth, generally stunted from lopping. Growth slow, 15-20 rings per inch of radius. Bark ¼-½ in. thick, somewhat corky in texture, grey or yellowish, often irregularly tesselated in small polygonal plates by wrinkles and deep furrows. Wood yellowish-white or grey, no distinct heartwood, but the colour often deeper near the centre. Very close-grained, compact, and heavy. Himalayan Boxwood resembles that from Europe, Smyrna, and the Black Sea in structure and mechanical properties; the pores are uniformly distributed, exceedingly fine and numerous; its weight is 60-65 lb. per cub. ft. The use of Boxwood for engraving, carving, turning, and mathematical instruments is well known: the Himalayan wood has by some authorities been stated to be softer and less fitted for these purposes; others, again, have found it equal to the best wood from Europe and western Asia. Boxwood to be used for engraving, requires careful and lengthened seasoning. In the N.W. Himalaya small boxes for butter, honey, snuff, and tinder are made of it, and in the plains it is carved into combs. The branches of the Himalayan Box are often placed on roofs of houses in the hills under the layer of earth with which they are covered, and last well when thus employed. The leaves are poisonous to cattle'; only goats eat them sparingly with impunity. In the south of France the leaves are largely used as manure in vineyards.

Baillon (Monographie des Buxacées, Paris, 1859) and Müller, DC. Prodr. xvi. i. 18, distinguish the Himalayan Box as a distinct species, under the name of *B. Wallichiana*, the difference mainly consisting in the length of the styles. The unpleasant smell of the flowers is also noticed in the Box grown in France (Mathieu Fl. For. 211).

Sarcococca saligna, Müll. Arg.—Syn. *Buxus saligna*, Don Fl. Nep. 63; *S. pruniformis*, Lindley Bot. Reg. t. 1012; *S. trinervia*, W. Ic. t. 1877; *Lepidodelma podocarpifolia*, Klotzsch in Reise des Prinzen Waldemar, t. 22—is a small evergreen glabrous shrub with alternate lanceolate or ovate-lanceolate leaves, more or less distinctly triplinerved, yellowish-white flowers in short axillary racemes, a few female flowers at the base of the racemes, and small purple ovoid berries. Afghanistan, Himalaya at 4000-7000 ft., Kasia hills, Nilgiris and western coast. Fl. March-May.

10. BRIEDELIA, Willd.

Trees, shrubs, or climbers; leaves alternate, short-petiolate, generally distichous, with prominent parallel lateral nerves. Flowers monoicous, subsessile, in axillary clusters; bracteoles numerous between the flowers. Calyx-tube more or less turbinate, often short and flat; segments 5, valvate in bud. Petals 5, smaller than calyx-segments. Male fl.: stamens 5, inserted on a central column, placed on a flat sinuate disc. Female fl.: ovary 2-celled, the base enclosed in the calyx-tube, and surrounded by an inner membranous, cup-shaped, or tubular disc, variously lobed or laciniate, which is inserted at the mouth of the calyx-tube, and is generally surrounded at its base by an outer fleshy annular disc; styles 2, bifid, more or less connate at the base. Fruit a berry, enclosing 2 indehiscent cocci.

Branchlets and under side of leaves tomentose; bracteoles few, coriaceous.
  A tree; lateral nerves 15-20 pair; calyx slightly enlarged in fruit . . . . 1. *B. retusa.*
  A climbing shrub; lateral nerves 8-12 pair; calyx much enlarged in fruit . . . . 2. *B. stipularis.*
Branchlets and leaves wholly glabrous; bracteoles numerous, thinly membranous . . . . 3. *B. montana.*

1. **B. retusa**, Sprengel.—**Tab. LV.**—DC. Prodr. xv. ii. 493; Bedd. Fl. Sylv. t. 260.—Syn. *B. crenulata*, Roxb. Fl. Ind. iii. 734; *B. spinosa*, Willd. ib. 735; *Cluytia spinosa*, Roxb. Cor. Pl. t. 172. Vern. *Pathor, mark*, Pb.; *Khāja*, Bijnaur, Oudh, Gorakhpur; *Kassi, khassi*, Oudh and C.P.; *Gauli*, Garhwal; *Angnēra*, Banswara; *Asana, asauna*, Bombay; *Tseikchyī*, Burm.

A middle-sized or large deciduous tree, spinescent when young, branchlets and under side of leaves usually soft-tomentose. Leaves short-petiolate, elliptic-oblong, 3-6 in. long, midrib prominent, with 15-20 pairs of prominent, straight, parallel, latreal nerves; stipules subulate, deciduous. Flowers monoicous, yellow, subsessile, crowded in lateral clusters, generally arranged in terminal paniculate spikes. Petals of male flowers on long claws, lamina thick, obovate, lobed; of female flowers lanceolate. Fruit subglobose, green, nearly black when ripe, fleshy, $\frac{1}{3}$ in. diam., supported by the somewhat enlarged coriaceous calyx. *B. crenulata*, Roxb., with axillary flowerheads, is said to be dioicous by Roxburgh. At present I am inclined to regard it as a variety only, chiefly found in Western India.

Sub-Himalayan tract, not common, ascending to 3500 ft., generally in moist ravines, found west as far as the Chenab. Common in the Oudh forests and on the Satpura range, in Bengal, Burma, Ceylon, South India, abundant in the forests of Western India, where I have found it north as far as Banswara near the Mhye river. Commonly associated with Sāl in Oudh and on the Satpura range. A middle-sized tree in North and Central India, not generally exceeding 30 ft. in height and 4 ft. in girth, but a large tree with a straight tall trunk in Bengal, Western India, and Burma, stems and branches of young trees have numerous scattered long sharp spines, which fall off as the tree gets older. Fl. May-July; fr. Oct.-Jan. Old leaves shed March-April, young leaves appear May, June. Bark thin, grey or brownish-black, rough, scurfy with small scales, sometimes deeply cracked, inner bark reddish, fibrous. Sapwood pale yellowish-white, heartwood grey, yellowish or dark olive brown, compact, even-grained and hard. Medullary rays fine, numerous.

Weight 54 lb. (R. Th., Cent. Prov.), 60 (Skinner), 66 (*Tseikchyī* from Burma, D. B., List No. 23). Not easy to work, but durable. Used for house-building, agricultural implements, and cart-building. The bark is very astringent and is used for tanning, the leaves are valued as cattle-fodder, and the tree is frequently lopped. The fruit is sweetish and eatable.

2. **B. stipularis**, Bl.; DC. Prodr. xv. ii. 499.—Syn. *B. scandens*, Roxb. Fl. Ind. iii. 736; *Cluytia scandens*, Roxb. Cor. Pl. t. 173. Vern. *Madlatāh, undergūpa*, Oudh.

A large, more or less climbing shrub, with drooping branches; branchlets and under side of leaves with soft tawny tomentum. Leaves short-petiolate, elliptic or obovate, 2-6 in. long; lateral nerves 8-12 pair, with prominent transverse veins at right angles; stipules broad-lanceolate. Flowers monoicous, yellow-tomentose, subsessile, crowded in lateral heads, in the axils of leaves or bracts, generally arranged in terminal paniculate spikes. Broad-lanceolate tomentose bracteoles between the flowers. Calyx-segments long-triangular, persistent and considerably enlarged in fruit. Drupes oblong-ovoid, often 2-seeded, nearly ½ in. long, black when ripe.

Sub-Himalayan tract, ascending to 2000 ft., from Jumna to Sarda. Abundant in the Oudh forests. Bengal, South India, Ceylon, Burma, Malay peninsula, Indian Archipelago. Fl. at various seasons, mainly May-Oct.

3. **B. montana**, Willd.; Roxb. Fl. Ind. iii. 735.—Syn. *Cluytia montana*, Cor. Pl. t. 171. Vern. *Geia*, Oudh, N.W.P.; *Kargnalia*, Kamaon.

A middle-sized tree, wholly glabrous, branchlets tuberculate. Leaves elliptic or obovate, pale beneath, 4-8 in. long, main lateral nerves 10-15 pair; stipules deciduous. Flowers monoicous, greenish, short-pedicellate, crowded in compact axillary heads with numerous, thin, membranous, ciliate and fimbriate bracts between the flowers; male and female flowers in the same head. Petals oblanceolate. Drupes ovoid-oblong, or globose (Roxb.), ¼ in. long, on short thick stalks, supported by the not enlarged membranous calyx.

Sub-Himalayan tract, west to the Jhelam, ascending to 3500 ft. Oudh forests (ravines in the hills). Bengal, Orissa, Behar. Fl. April, May; fr. Sept.-Nov. The leaves are lopped for cattle-fodder.

11. LEBIDIEROPSIS, Müll. Arg.

A small tree with alternate, short-petiolate, oval leaves; lateral nerves not prominent. Flowers monoicous or dioicous, subsessile, in axillary bracteolate clusters, male and female flowers in distinct clusters. Calyx-tube flat, shortly turbinate, segments 5, lanceolate, valvate in bud. Petals minute. Male flowers: stamens 5, filaments inserted on a central column, which is placed on a broad circular disc and prolonged into a short 3-lobed rudimentary ovary. Female flowers: ovary 3-celled, styles 3, bifid. Fruit a hard 3-celled, 6-valved capsule on a thick stalk. Seeds 3, cotyledons flat, fleshy.

1. **L. orbicularis**, Müll. Arg.—Syn. *Cluytia collina*, Roxb. Cor. Pl. t. 169; Fl. Ind. iii. 732. *Briedelia collina*, Wall. Vern. *Garrar*, *gharrar*, C.P.

A large shrub or small tree, with scanty light-green foliage. Branchlets, petioles, calyx and bracteoles hairy. Leaves glabrous, 2-4 in. long, with reticulate venation. Flowers yellowish green. Capsule 1 in. long; brown shining, ovoid or obovoid, indistinctly 3-lobed.

Satpura range, Bandelkhand, South India, Ceylon. Fl. June; fr. Dec., Jan. Bark blackish, very rough. Wood reddish, durable, but brittle. The rind of the fruit is said to be poisonous.

12. CLEISTANTHUS, Hooker.

Trees with alternate, short-petiolate, penniveined leaves, lateral nerves prominent. Flowers monoicous or dioicous, subsessile in axillary clusters or short spikes, with bracteoles between the flowers. Calyx-tube turbinate or cup-shaped, segments 5, valvate in bud. Petals 5, those of the male flowers minute. Male flowers: stamens 5, filaments free, inserted round a thick rudimentary ovary. Disc urceolate. Female flowers: ovary partly immersed in the calyx-tube, 3-celled, styles 3, more or less 2-fid. Disc membranous, cup-shaped or cylindric. Fruit a 3-celled 6-valved capsule. Seeds often connate in pairs at the base.

1. **C. oblongifolius**, Müll. Arg.—Syn. *Cluytia oblongifolia*, Roxb. Fl. Ind. iii. 731. *Briedelia oblongifolia*, Hooker & Arnott. Vern. *Dukesa*, Silhet.

A middle-sized tree. Leaves elliptic-oblong, acuminate, 6-12 in. long, glabrous above, pubescent beneath. Flowers greenish yellow, in small lateral clusters; bracteoles broad-ovate ciliate. Female flowers: calyx-tube turbinate, disc cylindric, laciniate at the top. Petals obovate, ciliate. Fruit ovoid, supported by the persistent base of calyx, $\frac{1}{3}$ in. long.

Silhet. Sub-Himalayan tract and outer valleys of Sikkim and Assam, ascending to 4000 ft. According to Stewart in the Siwalik tract of Kamaon, extending west to the Ganges. Fl. March-May; fr. Aug., Sept. Wood hard and durable (Roxb.)

13. PUTRANJIVA, Wall.

Trees with alternate, coriaceous, stipulate leaves. Flowers dioicous, the male flowers in axillary clusters; the female flowers pedunculate, axillary, solitary or a few together. Calyx of the male flowers 2-5-parted, of the female flowers 4-6-parted, segments narrow. Petals and disc wanting. Stamens 2-3, central, filaments free, monadelphous or diadelphous. Ovary 2-3-celled. Fruit indehiscent, 1-seeded with a hard bony endocarp.

1. **P. Roxburghii**, Wall.—**Tab. LIII.**—Wight Ic. t. 1876; Royle Ill. t. 83^{a}; Bedd. Fl. Sylv. t. 275.—Syn. *P. amblyocarpa*, Müll. Arg. DC. Prodr. xv. ii. 444. *Nageia Putranjiva*, Roxb. Fl. Ind. iii. 766. Sans. *Putranjiva.* Vern. *Putājan*, Pb.; *Jīa puta*, *joti*, *jūti*, *pūtra jiva*, N.W.P.; *Patji*, Oudh; *Jīvputrak*, Hindi.

A middle-sized evergreen tree, with dark-green foliage, branchlets and petioles pubescent. Leaves elliptic-oblong, with unequal-sided base, serrulate, short-petiolate, 3-5 in. long, the upper side glabrous, shining, lateral nerves numerous, joined by reticulate veins; stipules subulate, deciduous. Male flowers small, yellow, subsessile, numerous, collected in sessile irregularly globose axillary heads; calyx 3-5-cleft, stamens 3, filaments more or less connate. Female flowers pedunculate, axillary, often in twos or threes; calyx 5-6-cleft, segments oblong, obtuse. Ovary 3-celled, pubescent, styles 3, short, dilated into triangular lobed stigmas. Fruit ovoid, smooth, white, $\frac{2}{3}$ in. long, nut pointed, very hard, rugose, 1-celled, 1-seeded.

Sub-Himalayan tract, common in places, ascending to 2500 ft., and extending west to the Chenab, frequent in the Oudh forests. Bengal, Burma, South India, Ceylon, often cultivated. Generally in low shady, moist, mixed forests, often associated with *Eugenia* and *Ficus glomerata*. Fl. March-May, and the fruit ripens in Jan.-June of the ensuing year. Leaves renewed in April. A fine shady tree, which merits extended cultivation. Attains 40-50 ft., with a straight erect trunk, 4-5, at times 9 ft. girth, numerous divergent, spreading branches. Bark $\frac{1}{2}$ in. thick, grey, smooth or verrucose, with numerous horizontal lines of round light-coloured specks, inner bark yellow, fibrous. Wood light-grey, streaked with darker lines and patches, not very hard, even-grained and durable. Weight 36.6 lb. per cub. ft. (Wallich), probably heavier. Used in places for tools and in turning. The leaves are lopped for cattle-fodder, the nuts are strung up in rosaries and in necklaces for children to keep them in health, whence the name, "life of the child." The nuts of *Elæocarpus Ganitrus* (p. 43) are used in the same manner.

14. PHYLLANTHUS, Linn.

Trees shrubs or herbs; leaves stipulate, mostly distichous, entire, penniveined, short-petioled. Flowers monoicous or dioicous, in axillary or lateral clusters, sometimes solitary. Calyx-segments 4-9, generally 5-6, imbricate, without any appendages at the back. Petals none. Disc of distinct glands, alternating with calyx-segments, sometimes wanting. Stamens central, 2-15, generally 3, filaments free or variously connate. No rudiment of ovary in male flowers. Ovary 2-15-celled, generally 3-celled, 2 ovules in each cell; styles as many as cells, generally slender, bifid, and more or less connate. Fruit always dehiscent, sometimes fleshy. Seeds without arillus or strophiole.

Small trees with ovate or elliptic leaves; no disc or glands at the base of stamens or ovary; anthers 3-6 on a central column; styles connate into a short column; fruit a 4-6-celled capsule with red seeds. (Subgenus *Glochidion.*)
  Softly tomentose; anthers 3 . . . . 1. *P. nepalensis.*
  Glabrous; anthers 4-6 . . . . 2. *P. lanceolarius.*
A climbing shrub with elliptic or obovate leaves; disc of 5 distinct glands alternating with calyx-segments; stamens 5, the 3 inner connate into a central column; ovary 8-12-celled; styles distinct, minute; fruit a dark-purple small succulent berry . . . . 3. *P. reticulatus.*
A middle-sized tree with numerous linear leaflets; anthers 3-5 on a central column; ovary half enclosed in a cup-shaped disc; style 1, deeply 3-fid; fruit a large globose pale-yellow 3-celled berry . . . . 4. *P. Emblica.*

1. **P. nepalensis,** Müll. Arg. l. c. 291.—Syn. *Bradleia ovata,* Wall. Vern. *Gol kamela, (gūr)sawa, sama, chamār kas, amblu, kalm(a), koāmil,* Pb.; *Mowa, bakalwa,* N.W.P.; *Kari, koria,* C.P.

A small tree, branchlets softly tomentose. Leaves ovate or elliptic, pubescent on both sides, 2-3 in. long, short-petiolate, main lateral nerves arcuate, 4-6 pair; stipules subulate. Flowers in axillary fascicles, the female subsessile, the male on long filiform pedicels, male and female generally in the same fascicle. Male fl.: Calyx of 6 lanceolate segments, slightly hairy outside. Anthers 3, oblong, 2-celled, extrorse and cohering at the back, on a short central column, connective prolonged beyond the anther-cells. Female fl.: Calyx of 5-6 ovate segments, hirsute outside. Styles connate into a cylindric column, nearly as thick as the ovary, divided at the top into 4 thick ovate teeth longer than calyx, the lower part hirsute. Capsule 4-6-celled, pubescent, seeds red.

Sub-Himalayan tract and outer ranges, ascending to 5500 ft., and extending west to the Indus. Sikkim, Western Ghats, Canara, and Mysore. *Glochidion velutinum* and *arboreum*, Wight, t. 1907, from the Nilgiris, are probably the same species. Fl. and fruit Feb. to Aug. Attains 25 ft., and 3-4 ft. girth. Bark grey or reddish, with shallow longitudinal furrows. The leaves have a powerful nauseous smell. Wood brownish-white, compact but soft, the bark is used for tanning.

Glochidion neilgherrense, Wight; Bedd. Fl. Sylv. t. 277, a tree of the Nilgiris, is similar, but glabrous.

Phyllanthus bicolor, Müll. Arg. l. c. 311.—Syn. *Briedelia acuminata*, Wall., belongs to the same group, with 3 anthers, but differs by lanceolate leaves, glabrous above, slightly pubescent beneath along midrib, male and female fl. generally in separate fascicles, small 3-5-celled capsules on pedicels longer than the diam. of capsule. Nepal, Sikkim, Kasia hills.

2. **P. lanceolarius**, Müll. Arg.—Syn. *Bradleia lanceolaria*, Roxb. Fl. Ind. iii. 697; *Glochidion lanceolarium*, Dalzell Bombay Flora, 235. Vern. *Bhoma*, Bombay; *Angūti*, Silhet.

A small glabrous tree. Leaves shining, coriaceous, elliptic or elliptic-oblong, acuminate, 4-6 in. long, stipules triangular, main lateral nerves arcuate, 6-8 pair. Flowers pale greenish-cream-coloured in axillary fascicles, the male numerous, on long filiform peduncles, the female few and sessile. Male fl.: Calyx of 6 glabrous, linear-oblong segments. Anthers 4-6, oblong, 2-celled, extrorse and cohering at the back, on a short central column, connective prolonged beyond the anther-cells. Female fl.: Calyx of 6 unequal, thick, imbricate segments. Styles 6, glabrous, connate into a 6-sulcate, glabrous column, much thinner than the hairy ovary. Capsule shortly stalked, depressed, ½ in. diam., 4-6-celled, seeds red.

Kamaon Bhaber, Oudh forests (in moist ravines), Nepal, Sikkim Terai, Eastern Bengal, Burma. Fl. Dec.-April. Bark grey, with longitudinal wrinkles, the outer bark peeling off from the reddish-brown smooth inner layers. Roxburgh states that it grows to be a large useful timber-tree, the wood being hard and durable.

3. **P. reticulatus**, Poiret.—Syn. *P. multiflorus*, Willd. Roxb. Fl. Ind. iii. 664 (not Poiret); *Anisonema multiflora*, Wight Ic. t. 1899; Dalz. Bomb. Fl. 234. Vern. *Panjūli; (mākhi*, Bhurtpur).

A large straggling or climbing shrub with numerous stout woody branches, and long drooping branchlets. Leaves membranous, glabrous or slightly pubescent, elliptic or obovate, short-petiolate, about 1 in. long; lateral nerves joined by reticulate veins. Flowers in axillary fascicles, on slender pedicels, male fl. more numerous, generally 1 or 2 female fl. in a fascicle of male flowers. Calyx of 5 ovate membranous segments, and 5 distinct glands alternating with them. Stamens 5, the 3 inner longer, on thick filaments, more or less connate into a central column, the 2 outer short, free. Ovary globose, 8-12-celled; styles short. Fruit a black or dark-purple depressed succulent berry ¼ in. diam.

Common on low moist ground. North-West India, Sindh (climbing over the largest trees in the Belas along the Indus), Rajputana (Bhurtpur Ghunna), Bengal, South India, Burma, Ceylon, Indian Archipelago. Flowers nearly throughout the year. Bark grey; wood greyish brown, light, soft, pores large and numerous.

4. **P. Emblica**, Linn.—**Tab. LII.**—Roxb. Fl. Ind. iii. 671; Bedd. Fl. Sylv. t. 258.—Syn. *Emblica officinalis*, Gærtn.; Wight Ic. t. 1896. Sans. *Dhātri*, *āmalaka*. Vern. *Ambal*, *ambali*, Pb.; *Daula*, *āmla*, *amlika*, *aura*, *aunra*, *aola*, North and Central India; *Milli mara*, Gonds of Satpura; *Nelli mara*, Canarese; *Shabjū*, Burm.

A small or middle-sized tree with grey bark and light-green feathery foliage. Leaves linear acute, glabrous, ½ in. long, edge thickened, subsessile, distichous and approximate, imbricate when young, on hairy 4-8 in. long branchlets, having the appearance of pinnate leaves; stipules minute. Flowers small, greenish-yellow, in lateral fascicles on the leaf-bearing branchlets, in the axils of the leaves or on the naked portion of the branch below the leaves, female flowers few, subsessile, male flowers numerous, on short slender pedicels, both on the same branchlet. Calyx of 6 oblong obtuse segments. Disc in the male flowers of 6 minute glands. Anthers 3-5, extrorse on a central column. Ovary 3-celled, half immersed in an annular disc, style short with 3 recurved stigmas, dilated and lobed at the top. Fruit a fleshy globose berry, ⅔ in. diam., 3-celled, 6-seeded, with 6 prominent lines, pale yellow, sometimes reddish when ripe, of an acid and astringent taste.

Common in dry deciduous forests in most parts of India, except in the extreme north-west corner of the Panjab, ascending in Garhwal and Kamaon to 4500 ft. Burma, Ceylon, Indian Archipelago. Often cultivated. Fl. March-May; the fruit ripens Oct.-Feb. More or less leafless from February to April. Attains 30-40 ft., and 3-6, occasionally 9 ft. girth, but generally smaller. Trunk often crooked or gnarled, frequently with irregular excrescences, branches strong spreading. Bark thin, grey greenish or brown, with fine, close horizontal wrinkles, and few vertical cracks, inner substance dark red or purple, compact and fibrous. Wood mottled brown, red, and yellow, inner wood darker coloured, but no distinctly marked heartwood, hard, close- and straight-grained. Medullary rays very broad, of a lighter colour than the tissue between, showing on a vertical radial section like shining plates and giving a reticulate appearance on a tangential section. The broad medullary rays give the wood some resemblance to that of *Carallia integerrima*. Weight between 42.5 and 49 lb., value of P. between 532 and 617. Puckle (List of Western Mysore Woods, 1862) gives the weight at 67.5 lb., and the value of P. from 898 to 1052. Used for agricultural implements, and much valued for well-work, as it is durable under water. The bark is employed for tanning; chips of the wood and small branches thrown into impure or muddy water are said to clear it effectually (Pharm. Ind. 205). The fruit is the Emblic Myrobalan; used as a medicine, for dyeing and tanning, and pickled and eaten.

15. **BREYNIA**, Forst.

Glabrous shrubs with penniveined stipulate leaves. Flowers monoicous, axillary. Calyx turbinate, 6-lobed. Stamens central; three 2-celled anthers longitudinally adnate to a central column. Disc wanting. Ovary longer than calyx, truncate; styles minute. Seeds without arillus.

1. **B. rhamnoides**, Müll. Arg. l. c. 440.—Syn. *Phyllanthus sepiaria*, Herb. Roxb. (identified by Müller also with *P. Vitis-idæa*, Roxb. Fl. Ind. iii. 665). *Melanthesa rhamnoides*, Wight Ic. t. 1898. Vern. *Tīkhar*, Oudh.

A large shrub or small tree, wholly glabrous. Leaves ovate, obtuse, shortly petiolate, 1-1½ in. long; stipules triangular, acute. Flowers solitary, axillary, pedicels short, with a few membranous bracts at the base. Fruit a red globose berry.

Oudh forests common, Banda, Bengal, South India. Fl. April, May.

Melanthesopsis patens, Müll. Arg.—Syn. *Melanthesa turbinata* and *obliqua*, Wight Ic. t. 1897, 1898; *Phyllanthus turbinatus* and *patens*, Roxb. Fl. Ind. iii. 666, 667—is a shrub or tree of South India and Bengal, similar to *Breynia rhamnoides*, but distinguished by a trifid style and arillate seeds.

16. **SECURINEGA**, Juss.

Glabrous trees or shrubs with more or less distichous branchlets and penniveined stipulate leaves. Flowers usually dioicous, the male flowers in axillary fascicles. Calyx 5-cleft, segments imbricate, persistent, the 2 outer somewhat smaller. Petals none. Stamens 5, opposite to the calyx-segments; filaments free, filiform, surrounding a rudimentary 2-3-fid pistil as long as stamens. Disc of 5 glands alternating with the stamens. Ovary glabrous, 3-celled, 2 ovules in each cell, styles 3, connate at the base, generally bifid. Fruit more or less succulent, separating when ripe into 3 (sometimes 2 only) 2-seeded cocci.

Flower-bearing branchlets angular, unarmed . . 1. *S. obovata.*
Flower-bearing branchlets terete, spinescent . . 2. *S. Leucopyrus.*

1. **S. obovata**, Müll. Arg. l. c. 449.—Syn. *Phyllanthus retusus* and *virosus*, Roxb. Fl. Ind. iii. 657, 659. Vern. *Dalme*, *dhāni*, *bakarcha*, *ghāri*, *gwāla dārim*, N.W.P.

A large ramous unarmed shrub or small tree, wholly glabrous, branchlets angular. Leaves subsessile, oval or obovate, 1-2 in. long. Flowers dioicous, on slender pedicels, numerous, in axillary fascicles. Styles spreading or reflexed, deeply-cleft into 2 or 3 linear-segments. Fruit a white globose dehiscent berry, $\frac{1}{8}$ in. diam.

Trans-Indus at the base of the Suliman range (rare), not common in the sub-Himalayan tract of the Panjab. Common in Kamaon (ascending to 5000 ft.) Nepal, Bengal, South and Central India, Burma, Indian Archipelago, China, and Australia. Fl. (in North India) May, June ; fr. July-Oct. ; in Bengal in fl. and fr. nearly throughout the year. Attains 25 ft. or more, with a short erect trunk 3-4 ft. in girth. Bark grey, rusty or reddish-brown, with small light-coloured specks. Wood white, said to be close-grained, strong, and durable, and not attacked by insects ; it is used for agricultural implements. The bark is very astringent, and is used to intoxicate fish. The fruit is eaten.

2. **S. Leucopyrus**, Müll. Arg.—**Tab. LIV.**—Syn. *Phyllanthus Leucopyrus*, Roxb. Fl. Ind. iii. 658. *Flüggea Leucopyrus*, Willd. ; Wight Ic. t. 1875. Vern. *Perei pastawane*, Afg. ; *Karkūn*, *rūthei*, *girthan*, *gargas*, *bhāthi*, *bāta*, *vanūthi*, *girk*, Pb. (some of these names possibly apply to *S. obovata*) ; *Hartho*, *ainta*, N.W.P. ; *Kiran*, Sindh ; *Challa manta*, *sāle manta*, C.P.

A large spinescent shrub or small tree, wholly glabrous, branchlets terete. Leaves ovate, 1-2 in. long, petioles $\frac{1}{8}$-$\frac{1}{4}$ in. long. Flowers dioicous, on slender pedicels in axillary fascicles. Male flowers numerous, female flowers few. Styles erect or spreading, entire or shortly bifid. Fruit a white globose dehiscent berry $\frac{1}{6}$ in. diam.

Trans-Indus, eastern slopes of Suliman range, ascending to 3800 ft. Salt range, not uncommon. Sindh. Sub-Himalayan tract, ascending in Garhwal and Sikkim to 5000 ft. Bengal, Central and South India, Ceylon, Burma, Indian Archipelago, Australia. Fl. chiefly May, June ; fr. July-Sept., often remaining long on the tree. Bark ash-coloured, dark-bluish, or dark reddish-brown with small white specks. Wood close-grained, strong, chiefly used as fuel. The fruit is eaten.

17. ANDRACHNE, Linn.

Shrubs and undershrubs with alternate, stipulate, entire, generally ovate leaves. Flowers monoicous, male flowers generally fasciculate, female flowers solitary, axillary on long slender pedicels. Calyx-segments 5-6, imbricate in bud. Petals as many as calyx-segments, shorter than calyx, those of the female flowers minute. Disc of free or connate glands. Stamens 5-6, around a cylindric rudiment of ovary, filaments free or monadelphous. Ovary 3-celled, styles 3, connate at the base, the free portion dichotomous ; stigma capitate, minute. Fruit a 6-valved capsule. Seeds without aril or strophiole.

1. **A. cordifolia**, Müll. Arg. ; DC. Prodr. xv. ii. 234.—Syn. *Phyllanthus cordifolius*, Wall. *P. Hoffmeisteri*, Klotzsch. Reise des Prinzen Waldemar, t. 24. *Leptopus cordifolius*, Decaisne in Jacq. Voy. Bot. t. 156. Vern. *Kūrkni*, *gūrgūli*, Jhelam ; *Bersu*, Chenab ; *Barotri*, *madāre*, Ravi ; *Mūtkar*, *chīrmūtti*, *pīn*, Bias ; *Tsātin*, Sutlej.

A shrub with slender branches, in places only an undershrub, extremities, petioles, and under side of leaves hairy. Leaves ovate-oblong, obtuse, penniveined, blade 1-2 in., petiole filiform, ¼-¾ in. long. Flowers monoicous, axillary, on long filiform pedicels. Disc of male flowers consisting of 5 flat bifid glands. Styles shortly connate at the base, deeply bifid. Capsule ¼ in. across.

Common in the North-West Himalaya from the Indus to Nepal, ascending to 8000 ft. (Dippi forest). Fl. May-Sept.

A. telephioides, Linn., is a small undershrub of the Mediterranean region and West Asia, found also in the Panjab Salt range, with ovate or obovate leaves. *A. aspera*, Sprengel, has reniform or orbicular leaves and grows from Egypt to Sindh.

ORDER LXX. BETULACEÆ.

Trees with scaly buds and alternate penniveined simple leaves; stipules deciduous. Flowers monoicous in drooping catkins. Male flowers: bracts stalked, often peltate, bearing on the stalk and on their inner face 2-3 generally tetrandrous flowers with small perianths of membranous, often unequal scales. Anthers 2-celled, cells often distinct. Female flowers: 2 or 3 in the axils of (generally) 3, more or less connate bracts; perianth none. Ovary free, compressed, 2-celled, 1 pendulous ovule in each cell. Fruit a small 1-seeded nut. Seeds without albumen; cotyledons flat, radicle superior. The cotyledons of the germinating embryo are raised above the ground.

Anther-cells distinct; scales of female catkin deciduous . . . 1. BETULA.
Anther-cells more or less connate; scales of female catkin persistent, enlarged and woody in fruit . . . . 2. ALNUS.

1. BETULA, Tournefort.

Deciduous trees with serrate leaves, resinous dots beneath. Anthers 8-12 inserted on the inside or stalk of the bract, more or less distinctly arranged in tetrandrous flowers, each anther opposite to a membranous scale; anther-cells distinct. Female flowers, 3 in the axil of each bract. Bracts of catkin deciduous in fruit, generally membranous. Fruit with a membranous wing on 2 sides.

Female catkins single; bracts in fruit indurated, deeply 3-lobed, broader than wings; wings narrower than fruit . . 1. *B. Bhojpattra.*
Female catkins fasciculate; bracts in fruit membranous, linear-oblong, with 2 small teeth or lobes at the base, narrower than wings; wings much broader than fruit . . . . 2. *B. acuminata.*

1. **B. Bhojpattra,**[*] Wall.—Syn. *B. Jacquemontii*, Spach.; Jacq. Voy.

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[*] I retain Wallich's name *Bhojpattra* (Pl. As. Rar. ii. 7, 1831), which is adopted by Lindley, Bot. Reg., and Regel (Monographia Betulacearum, 1861, and DC. Prodr. xvi. ii. 177), though it seems certain that Don's *B. utilis* (Prodr. Fl. Nep. 58, 1825) was intended for this tree. But Don's description, "foliis ovatis acuminatis inæqualiter ser-

Bot. t. 158. Sans. *Bhurja.* Vern. *Būrj, bhūj, būrzal, phurz,* Pb. Himalaya; *Shāg, shak, pād, phatak, takpa,* Ladak, Lahoul, Piti, Kunawar; *Bhūjpattra,* N.W.P.

A moderate-sized tree, shrubby near its upper limit; extremities, petioles and leaf-buds pubescent, the bark exfoliating in thin broad horizontal belts. Leaves ovate, acuminate, unequally serrate, hairy along midrib, pubescent when young with scattered hairs; blade 2-3 in., petiole ½ in. long; main lateral nerves 8-12 pair, prominent beneath, impressed on the upper side; the under side generally with resinous dots. Bracts of male flowers stalked, the stalk bearing numerous glabrous scales, ciliate at the edge, the lower membranous, transparent, the upper coloured. Anther-cells distinct, glabrous, with a tuft of few hairs at the tip. Bract of female flowers pubescent, deeply 3-lobed, hardened in fruit, broader than the winged fruit; lobes linear-oblong. Wings narrower than greatest breadth of nut.

Higher ranges of the Himalaya, extending far into the inner arid tract, in the Panjab not under 7000, in Sikkim and Bhutan not under 9500 ft., ascending commonly to 11,000, and often to 12,000 ft., in Zanskar, Tibet, and inner Sikkim to 14,000 ft. Chūr at 12,150 ft. Afghanistan. Higher mountains of Japan. Gregarious, forming pure forests, often at the upper limit of arborescent vegetation, generally rising 500 ft. above the upper limit of *Abies Webbiana;* seems to prefer north and west aspects. The leaves are shed in Oct., and the new foliage comes out in April and May. Attains 50-60 ft.; trunk erect, somewhat crooked, 6-7 and at times 10-12 ft. girth; branches erect, twigs drooping, forming a handsome broad-oval crown with light foliage. Bark smooth, wrinkled, reddish- or purplish-brown, with whitish linear or oblong stripes (lenticels) and fine parallel lines, the outer bark consisting of numerous distinct paper-like layers, exfoliating in broad horizontal rolls or belts. Wood white, straight-grained, not hard, but tough to cut. Weight 35.5 lb. per cub. ft. (Wall.) In the arid inner Himalaya, where timber is scarce, it is used extensively for building, and other purposes. It is elastic, and has been recommended for turning. The bark is the most valuable part of this tree; it is used as paper for writing and packing, for umbrella-covers, and to line the inside of the hooka-tube. Hindoos use it in various religious ceremonies. It is called *Toz, bhoj pattar,* in Kashmir, *drawa* on the Chenab, and *bharangi* in Kamaon, and is largely exported to the plains. In Kashmir and Kunawar it is often placed under the flat earth roofs, and is said to be very lasting. Twig bridges are made of the branches of this Birch, and the trees are often lopped for fodder.

2. **B. acuminata,**[*] Wall.—**Tab. LVI.**—Pl. As. Rar. t. 109.—Syn. *B. cylindrostachys,* Wall.; DC. Prodr. xvi. ii. 179. Vern. *Pūya ūdish, chambar māya,* Pb.; *Bhūjpattra, hāur, shāul,* N.W.P.; *Shakshin,* Tibet; *Utis,* Nepal.

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ratis utrinque ramulisque villosis basi rotundatis subtus canescentibus," hardly applies to this species, and certainly does not give its distinguishing characters. Don adds, on Wallich's authority, that the epidermis is used under the name of *Bhog Pattrah;* but this proves nothing, for both species of Birch are called *Bhuj pattra* in the N.W. Himalaya.

[*] I retain this name, which is supported by Wallich's plate and description. Don's *B. alnoides,* which he describes as dioicous, and *nitida,* are probably synonyms, but Don's descriptions are insufficient to identify them. *B. nitida,* Don, is retained as a distinct but doubtful species in De Candolle's Prodromus.

A moderate-sized tree, the current year's branchlets pubescent; root-suckers and luxuriant shoots soft-tomentose. Leaves ovate or ovate-lanceolate, acuminate, unequally serrate, teeth cuspidate, often aristate, more or less pubescent, sometimes soft-tomentose beneath when young, glabrous and often shining when full-grown, with scattered hairs on the under side along midrib, numerous brown red or black resinous dots on the under side; blade 3-6 in., petiole ½ in. long; main lateral nerves 8-12 pair. Catkins fasciculate, short-pedunculate, 3-4 in. long, slender while in flower, ¼ in. diam. while in fruit. Bracts of male catkin subsessile, with 3 tetrandrous flowers on the midrib; perianth of 4 hairy linear leaves; anthers hairy, cells distinct. Bracts of female catkin lanceolate at the base, with 2 obtuse or acute teeth or short lobes, as well as ovaries and styles hairy with long hairs. Wings much broader than fruit, and broader than the membranous bract of the fruit.

Himalaya, generally in the outer ranges, extending west to the Sutlej basin, commonly between 5000 and 10,000 ft. Kasia hills 3000-5000 ft. In shady mixed forests, in valleys near streams, mostly singly, not gregarious. Fl. Nov., Dec.; fr. April, May. Attains 50-60 ft., trunk short, 6 ft. girth and more, branchlets somewhat drooping. Wood whitish, there is some doubt regarding its qualities: Wallich, Pl. As. Rar. ii. p. 7, states that it is hard and greatly esteemed by the inhabitants of Nepal, and is employed for all purposes where strength and durability are required. The bark peels off in thick rolls, the lenticels are shorter than in *B. Bhojpattra*, elliptic or elliptic-oblong.

Betula alba, Linn.; Hook. Stud. Fl. 346—*Birch; Birke*, German; *Bouleau*, French—the most important of the numerous species and varieties of this genus in Europe, has long-petioled rhomboid or ovate leaves, solitary female catkins, the fruiting bracts with a cuneate base and a broad 3-lobed apex, wings twice or nearly thrice the breadth of fruit. The wood is yellowish- or reddish-white, with numerous fine medullary rays, and numerous fine, uniformly distributed pores. No heartwood. Weight 32-48 lb. Excellent fuel. Used for carving, furniture, and agricultural implements; in the Highlands of Scotland, and in North Scandinavia also, for building and a variety of other purposes. The bark is used on roofs under a layer of earth like the Himalayan Birch, and is said to be imperishable. Baskets, boxes, mats, and cordage are made of it in Lapland.

B. papyracea, Willd., the *Paper* or *Canoe Birch*, is a most useful large tree in Canada and the Northern United States. The bark splits into fine paper-like layers, is used as paper, for thatching, and ornaments are made of it. But its principal use is to make the light portable canoes used on the lakes and rivers of Canada. In spring the bark is detached for this purpose in plates 10-12 ft. long and 33 in. broad, which are stitched together with fibrous roots of the white Spruce (*Abies alba*, Michaux). Regel classes this Birch as a sub-species under *B. alba*.

2. ALNUS, Tournef.

Deciduous, rarely evergreen trees, with dentate, sometimes entire leaves. Male fl.: either tetrandrous, with 4-lobed perianth, or 6-12 anthers inserted on the stalk of the bract, in the axils of membranous scales; anther-cells connate, rarely distinct. Female fl.: 2 in the axil of each bract; bracts

indurated, woody, persistent in fruit, covered before maturity by a waxy or resinous substance. Nuts with a membranous or coriaceous wing, or unwinged.

Branchlets glabrous ; fruit catkins numerous in large erect panicles . . . . 1. *A. nepalensis.*
Branchlets pubescent ; fruit catkins 3-5 in short erect racemes . 2. *A. nitida.*

1. **A. nepalensis**, D. Don ; Wall. Pl. As. Rar. t. 131.—Vern. *Kohi, koe*, Pb. ; *Udīs, udīsh, wūsta*, N.W.P. ; *Boshi swa*, Nepal.

A moderate-sized tree ; branchlets glabrous. Leaves coriaceous, glabrous, with tufts of hairs in the axils of lateral nerves, elliptic, acute, entire or indistinctly denticulate, blade 4-6, petiole ¾ in. long ; main lateral nerves 14-18 pair. Flowers appearing after the leaves. Catkins paniculate or racemose. Male catkins subsessile, slender, 4-10 in. long, numerous, in large terminal pedunculate drooping panicles ; each bract with 6-12 anthers on short filaments, more or less distinctly separated by ciliate scales into several 2-4-androus flowers ; anther-cells connate. Female catkins ¼ in. long, pendulous in flower ; perianth-leaves and stamens 10-12, in lateral racemes or racemose panicles. Fruit catkins ovoid or subcylindric, short-pedicellate, ½-1 in. long, in erect lateral panicles. Wings of fruit membranous, narrow, often broader at the top, somewhat irregular.

Himalaya, extending west to the Ravi, between 3000 and 9000 ft. Kasia hills. Mixed forests, often in ravines, or fringing the banks of streams. Fl. Oct.-Dec. ; the fruit ripens in winter, and remains long on the tree. Attains 50-60 ft., with an erect, straight trunk and a shady crown. Bark thick, compact, outside purplish or yellowish silvery, somewhat resembling the bark of birch. Wood pale brownish-red, with large very distinct reddish-brown medullary rays. The bark, exported to the plains under the name of *Utis*, is used for tanning and dyeing.

2. **A. nitida**, Endl.—**Tab. LVII.**—Vern. *Gīra*, Afg. ; *Shrol, srol, saroli, sawāli, rikūnra, chāmb, chaāp, chāpu, tsāpu, piāk, kūnsa, kūndash, niū*, Pb. Himalaya ; *Rajān, rajāin*, Pb. plains.

A large tree ; current year's petioles and branches pubescent. Leaves subcoriaceous, glabrous, with tufts of hairs in the axils of lateral nerves beneath, ovate, acuminate, more or less distinctly dentate ; blade 4-6, petiole 1-1½ in. long ; main lateral nerves 8-12 pair. Flowers appearing after the leaves ; catkins racemose. Male catkins short-pedicellate, drooping, 2 in. long, 4-6 in terminal erect bracteate, and at the base often leaf-bearing racemes. Anthers sessile, densely crowded, so that the arrangement into distinct flowers cannot be traced ; anther-cells nearly distinct. Fruit catkins ovoid or cylindric, on short stalks, ¾-1½ in. long, 3-5 in erect lateral racemes. Fruit with a narrow coriaceous edge.

Common in the Panjab Himalaya, ascending to 9000 ft., and not uncommon along the banks of the main rivers some distance into the plains. On the Sutlej, its upper limit is Spūi on the right, and Namgia on the left bank. Pabur and

Tonse rivers. Generally fringes the banks of mountain-streams and rivers. Fl. Sept.-Oct. Attains 80-90, and at times 100 ft., with a straight tall clear trunk, generally 6-8, often 12, and at times 15 ft. girth. The largest trees are seen in the basins of the Jhelam and Chenab. Bark brown, rough with dark furrows. The wood is whitish, used for bedsteads; the hooked sticks of rope bridges are made of it. The twigs are tough, and are used for tying loads and in the construction of twig bridges. The bark is used for dyeing and tanning.

A. orientalis, Dne.; DC. Prodr. xvi. ii. 185, somewhat resembles this species, but differs by large short ovoid or subglobose fruit catkins, fruit without wing or edge. Syria, Lebanon, Cyprus, Cilicia.

The two sp. of this genus which are important for the forester in Europe are: 1. *A. glutinosa*, Linn.; Hook. Stud. Fl. 346; *Alder; Schwarzerle*, German; *Aune glutineux*, French; *Ontanonero*, It., with glabrous glutinous leaves. Europe, North Africa, Cilicia, Asia Minor. Important as coppice-wood in deep marshes. Wood soft, white when fresh cut, turning, on exposure to the air, into orange-red, pale red when seasoned, the wood of knotty trees often beautifully mottled. No heartwood. Weight 26-40 lb. Used for carving; herring-barrels are made of it. Lasts well under water. 2. *A. incana*, Willd.; *Weisserle*, Germ.; *Aune blanc*, Fr.; with pubescent leaves. North-East Europe, and mountains of Central Europe, descending to the plains along the main rivers, and often cultivated. Caucasus, Siberia, Amurland. Throws up abundantly root-suckers. Both have distinctly tetrandrous flowers, 4 on the stalk of each scale, with 4-lobed perianth, fruit with a narrow coriaceous edge.

ORDER LXXI. SALICINEÆ.

Deciduous, fast-growing but not long-lived trees or shrubs, with scaly buds. Wood soft, light, even-grained. Leaves alternate, simple, stipulate. Flowers dioicous in lateral catkins, which are similar in both sexes, with spirally-arranged scales, each bearing one flower in its axil. A glandular cup-shaped or irregularly-formed disc, in the male fl. with two or more, generally free stamens; in the female fl. with a 1-celled ovary, consisting of 2-4, generally 2, connate carpels which terminate in as many short styles as there are carpels, numerous ovules on parietal placentas adnate to the median line of the valves. Fruit a 1-celled 2-4-, generally 2-valved capsule dehiscing from the apex, the valves spreading or rolling back. Seeds numerous, minute, with a mass of long silky hairs on the funicle, which enclose the seed; albumen none; embryo straight; radicle inferior. Fruit catkins not persistent.

Leaves short-petiolate; scales entire; stamens 2-12, generally 2, long exserted; capsule 2-valved	1. SALIX.
Leaves long-petiolate; scales cut or jagged; stamens 4-30; capsule 2-4-valved	2. POPULUS.

1. SALIX, Tournef.

Leaves lanceolate ovate or elliptic, petioles short, generally less than one-fourth the length of leaf. Stipules deciduous, larger and more persistent on shoots and root-suckers. Scales of catkins deciduous or more or less persistent, lanceolate rotundate or obovate, entire. Disc of 2 glands or nearly annular. Stamens 2-12, generally 2, long, protruding from the scales, filaments filiform, free or more or less connate. Stigmas 2, often bifid or lobed, at the end of a short or elongated filiform, sometimes bifid style. Capsule 2-valved, the valves generally rolling back, placentas near the base of the valves.

In the following enumeration, a selection has been made of the more important willows of N.W. India, and notes have been added regarding those European willows which are most nearly related to them. The study of this genus is difficult, on account of the numerous hybrids and cross-breeds between the different species. The arborescent willows are most useful trees, and merit great attention on the part of foresters in India.

Willows are invaluable to protect and fix the banks of rivers, and extensive plantations for that purpose may be seen all along the banks of the Rhine and other large European rivers. As coppice-woods with short rotation they are grown in Osier-beds, and cut annually (for basket-work), or when 3-4 years old, for hoops and other larger material. Along roads, brooks, and on meadows they are often grown as pollards. The wood is used for carving and many other purposes. The inner bark is tough and fibrous, fishing nets and lines are made of it in North America.

- Stamens 3 or more, free.
  - Leaves lanceolate, serrulate; capsules ovoid, long-pedicellate . . . . 1. *S. tetrasperma.*
  - Leaves linear-lanceolate, entire; capsules ovoid-lanceolate, short-pedicellate . . . . 2. *S. acmophylla.*
- Stamens 2, free.
  - Flowers with or after the leaves; catkins on leaf-bearing peduncles.
    - A tree with generally drooping branches; leaves linear-lanceolate, glabrous; style short . . . . . 3. *S. babylonica.*
    - A tree with spreading branches; leaves lanceolate, silky beneath; style short . . . . 4. *S. alba.*
    - A large shrub or small tree; leaves elliptic or obovate-oblong, glabrous, glaucous beneath; style short . 5. *S. elegans.*
    - A small shrub; leaves broad-elliptic, green on both sides, paler beneath; style long filiform . . . . . 6. *S. hastata.*
  - Flowers before the leaves; catkins sessile or subsessile.
    - Stigma sessile or subsessile.
      - Leaves elliptic or obovate, rugose, crenate . . . 7. *S. Caprea.*
      - Leaves lanceolate or ovate-lanceolate, not rugose, entire . . . . 8. *S. Wallichiana.*
    - Style long, slender.
      - Leaves lanceolate, glabrous, serrate, glaucous beneath; capsule glabrous . . . . 9. *S. daphnoides.*
      - Leaves linear-lanceolate, white-tomentose beneath; margin revolute; capsule grey-tomentose . . 10. *S. viminalis.*
- Stamens 2, connate to the apex or nearly so.
  - Leaves linear-lanceolate; scales dark-coloured at top, with long silky hairs . . . . 11. *S. pycnostachya.*
  - Leaves narrow-linear; scales yellow, glabrous . . . . 12. *S. angustifolia.*

1. **S. tetrasperma**, Roxb.—**Tab. LVIII.**—Cor. Pl. t. 97; Roxb. Fl. Ind. iii. 753; Wight Ic. t. 1954; Andersson in DC. Prodr. xvi. ii. 192; Bedd. Fl. Sylv. t. 302.—Syn. *S. ichnostachya*, Lindl.; Wight Ic. t. 1953.

Vern. *Bed*, *bet*, *bent*, *bāishi*, Hindi ; *Laila*, *bains*, *bhainsh*, N.W. India. Local n. : *Badha*, Pb. plains ; *Bīs*, *bīsh*, *beis*, *bītsa*, *bīn*, *bidu*, *kschme*, *bakshel*, *magsher*, *safedar*, Pb. Himalaya ; *Yīr*, Kashmir ; *Bilsa*, Oudh ; *Pani jamā*, Bengal ; *Wallūnj*, *bacha*, Bombay ; *Momakha*, Burm. *Bed* is the Persian name for willow ; no Sanscrit name is known.

A small or moderate-sized tree, extremities with long silky hairs. Leaves lanceolate, rarely ovate-lanceolate, 4-6 in. long, serrulate with minute serratures, glaucous beneath, glabrous when full-grown, or with a few soft adpressed hairs, often long persistent and subcoriaceous ; main lateral nerves numerous, prominent. Flowers after the leaves, catkins on leafy peduncles ; scales pale, those of the female catkins deciduous. Male catkins sweet-scented, lax, drooping, 2-3, sometimes 4 in. long, rachis, scales and base of filaments hairy ; fl. 5-10-androus ; stamens free, anthers minute, elliptic. Fruit catkins lax ; capsules 2 lines long, on slender pedicels half the length of capsule or longer, often in groups or half whorls of 3-4, glabrous or hairy, mostly rugose when ripe, ovoid, base often subglobose, narrowed into a short style with 2 spreading, generally entire stigmas ; gland semicircular, many times shorter than pedicel, seeds 4-6. Andersson describes the capsules as "glaberrimæ." Wight (*ichnostachya*) and Beddome figure them as pubescent, and I have found them hairy in several cases. Roxburgh describes them as 4-seeded, whence the name, which Andersson retains on account of the arrangement of the capsules ("capsulæ subquaternatim collectæ").

Common on river-banks and in moist places nearly throughout India ; in Sindh and the plains of the Panjab only planted, except near the banks of the Chenab, and other Himalayan rivers. Sub-Himalayan tract and outer ranges of the Himalaya, west to the Indus, ascending to 6000, and at times to 7000 ft. Ascends to 7000 ft. on the mountains of South India. Java. Often gregarious. R. Thompson mentions a forest of great extent in the swamps of Dharmapur in Baraich. Cultivated in Afghanistan. In North India the leaves are shed in Dec. and Jan., the new foliage appearing Feb.-March. In Burma I have seen it leafless during the rains. It flowers in autumn and the cold season, but also in March and April. The seeds in this as in the other willows ripen soon after flowering. Attains 30-40 ft., with a straight trunk, hollow when old, 5-6 ft., and not rarely 10 ft., in girth. Bark ½ in. thick, grey brown or blackish, rough with broad shallow, irregular vertical furrows, and irregularly-shaped plates between the furrows. Where the tree grows near water, particularly if subject to inundation, the lower part of the stem gets covered, often 2-3 ft. high, with numerous small rootlets.

Sapwood large, whitish, heartwood distinct, of dark-brown colour (R. Thompson). The Burma wood weighs 37 lb. (D.B. List of 1862). Not much used. The charcoal has been used in the manufacture of gunpowder. Baskets are made of the twigs, and the leaves are given as cattle-fodder, the tree being often lopped for that purpose. According to Dalzell (Bombay Fl. Suppl. 82), the bark is used as a febrifuge ; it is, however, believed not to contain any salicine (Pharm. Ind. 213).

S. pyrina, Wall. ; DC. Prodr. xvi. ii. 193, from Nepal, is very similar, only more hairy, and the capsules more elongated.

2. **S. acmophylla**, Boiss. ; DC. Prodr. 195.—Vern. *Bed*, Afg. ; *Bada*, *bīsu*, Pb. Himalaya.

A moderate-sized glabrous tree; branchlets often pendulous. Leaves linear-lanceolate, entire, wholly glabrous, pale or glaucous beneath, 2-3 in. long. Flowers after the leaves, catkins on leaf-bearing peduncles; scales pale, with long silky hairs, those of female catkins deciduous; male catkins compact, cylindric, erect or slightly nodding, 1-2 in. long, scales and base of filaments with long silky hairs; stamens 4-6; anthers short, elliptic, or nearly circular. Female catkins nodding, 1 in. long, capsules on short pedicels, ovoid-conical, glabrous, style short, with 2 spreading entire stigmas.

Afghanistan, Sindh, N.W. Himalaya (Indus to Bias), and near Delhi. Often cultivated. Persia and Syria. Fl. Feb., March. A handsome tree with a straight trunk 6-7 ft. girth, often much larger, branches lax, forming a rounded crown, the branchlets often pendulous. About Quetta the tree is much lopped for cattle-fodder.

Andersson refers to this *S. glaucophylla* and *dealbata*, two species previously established by him upon specimens collected in North-West India by Jacquemont. Some specimens, however, which evidently belong to this species, in Herb. Kew. were referred by him to *S. octandra*, Sieber, which is identified with *S. Safsaf* in his Monographia Salicum, 1863, p. 10, and in the Prodromus, p. 196. Aitchison (Cat. 140) calls the tree *S. octandra*, Del., and Stewart referred it to *S. Safsaf*, Forsk. This, however, is a different tree, with serrulate leaves, 8-androus flowers and subglobose capsules on long slender pedicels, common in Nubia, Abyssinia, and Egypt. Geographically, and as regards characters, *S. acmophylla* appears to be intermediate between *S. tetrasperma* and *Safsaf.*

There is another willow in Afghanistan, apparently intermediate between *S. Safsaf* and *S. acmophylla*, with serrulate leaves, wholly glabrous, glaucous beneath, lateral nerves numerous, distinct, small erect male catkins, stamens 3-8, and large ovoid capsules on long slender pedicels. A low shrub with long red branches, in river-beds near Topchi, with *Berberis*, *Tamarix*, *Rosa*, *Hippophaë*, in other places a middle-sized tree with pendulous branches (Griffith).

S. ægyptiaca, L., is, according to Andersson in DC. Prodr. 196, an uncertain species. Dalzell (Suppl. to Bombay Fl. 81) quotes it as growing on the road from Poona to Kandalla, and describes it with very narrow, almost linear leaves, branches not drooping, and the flowers like those of *S. tetrasperma.*

S. triandra, L.; Hook. Stud. Fl. 336—Syn. *S. amygdalina*, L.; Reichenb. Ic. Fl. Germ. t. 604, is a large glabrous shrub or moderate-sized tree. Leaves wholly glabrous, oblong-lanceolate, serrate, with glandular teeth, stipules semicordate, flowers with the leaves; catkins on leaf-bearing peduncles. Male catkins slender, slightly drooping; the flowers triandrous, lax; disc of 2 glands. Capsules glabrous, pedicellate, stigma subsessile. Common in Osier-beds, yields excellent material for basket-work. Bark of old trees exfoliating in thin flakes. Throughout Europe, north to Lapland. Caucasus and Siberia.

S. pentandra, L.; Hook. Stud. Fl. 336; Reichenb. Ic. Fl. Germ. t. 612, is a glabrous shrub or large tree. Leaves wholly glabrous, viscid when young, shining, subcoriaceous when full-grown, elliptic or elliptic-lanceolate, obtusely dentate; teeth often glandular. Flowers after the leaves, catkins on long leaf-bearing peduncles. Male catkins compact, cylindric, drooping, the flowers 4-12-generally 5-androus, close together. Capsules glabrous, pedicellate; stigma subsessile. Disc of 2 glands in both male and female flowers. Throughout Europe (north to Lapland), North Asia.

The bark of the two last-named, as well as that of several other species—*e.g.*, *S. daphnoides* and *purpurea*—is bitter, and contains a crystalline principle called Salicine, which has been used in Europe, with doubtful success, as an antiperiodic and tonic. The bark of some kinds contains as much as 3-4 per cent of this substance.

3. **S. babylonica**, Linn.—**Tab. LIX.**—DC. Prodr. xvi. ii. 212.—Syn. *S. pendula*, Mœnch; C. Koch, Dendrologie, ii. 507. *Weeping Willow.* Vern. *Bīsa*, *bada*, *bed*, *katīra*, *majnūn*, Pb.; *Giūr*, Kashmir.

A large tree with drooping branches, glabrous shining branchlets, and thin cylindric acute buds. Leaves glabrous, pale or glaucous beneath, petiole sometimes hairy and the youngest leaves occasionally with a few adpressed hairs, linear-lanceolate, 3-6 in. long, generally not more than ½ in. wide, finely serrulate, midrib whitish, prominent, lateral nerves numerous but not conspicuous; stipules falcate, serrate. Flowers appearing with the leaves; catkins on peduncles with a few small leaves. Male catkins short, cylindric, slender, curved, ½-1 in. long, of a straw-yellow colour; scales lanceolate, pale, hairy as well as rachis; stamens 2 free, anthers short, elliptic. Female catkins drooping, 1 in. long; scales lanceolate, pale; capsules sessile, conical, glabrous or slightly pubescent at the base; stigmas 2, sessile.

Cultivated in Afghanistan. Commonly planted in the plains of North-West India, westward more common; also in the Himalaya (to 9000 ft. on the Jhelam), Kamaon, Nepal, Sikkim (to 7000 ft.), Bhutan (to 8000 ft.) In North India the male tree is much more common than the female tree. Wild, according to Dr Stewart, in places on the eastern flanks of the Suliman range, and "apparently indigenous," according to Aitchison (Cat. 140), in one locality near Hushiarpur.

Cultivated in South and Central Europe (Britain, Denmark, but not in Northern Scandinavia and Russia), and in most subtropical countries. Possibly wild in North China, Persia, and Kurdistan (the specimens collected by Kotschy are in leaf only). Introduced into Europe, the female tree only, and propagated by cuttings, in the seventeenth century, possibly earlier; represented by Benvenuto Cellini on a basin at Florence, executed in the sixteenth century. (Extracts from Targioni-Tozetti, historical notes on the introduction of various plants into Tuscany, in Journ. Hort. Soc. of London, ix. 1855, 177.) Not mentioned by classical writers. The *Garab* of the 137th Psalm, which Linnæus considered the Weeping Willow, and called *S. babylonica*, was, as pointed out by C. Koch l. c. 507, probably not a Willow, but *Populus euphratica*. In the Panjab it is leafless during the cold season, and the new foliage appears in Feb., March. Fl. Feb.-May. Attains 50 ft. with a straight erect trunk, 6-7 ft., at times 10-12 ft. girth, branches numerous large spreading, forming an elegant oval crown, the branchlets always drooping, sometimes nearly reaching the ground exactly as the Weeping Willow cultivated in Europe. Bark ¼-½ in. thick, grey, yellowish-grey or brownish, cleft into narrow smooth shining plates by wide, shallow, rough furrows and short straight transverse cracks. Wood close- and even-grained, takes polish. The chief use of the tree is that the branches are made into baskets, wattles, and are used for weirs and the protection of canal-banks. It is propagated by cuttings, and grows rapidly if sufficiently supplied with water. Dr Stewart records 4-5 rings per in. and a girth of 4 ft. as the average of 6 trees, 10 years planted out.

Andersson classes *S. japonica*, Thunb. Fl. Jap. 24, with longer cylindrical male catkins and sharply-serrate leaves, as a variety of *S. babylonica*. C. Koch l. c. 506, keeps it distinct, and states that the branchlets are not pendulous. Kæmpfer describes the tree with hanging branches. The Weeping Willow of Europe is probably nothing but the pendulous variety of a Willow with erect branches, analogous to the Weeping Ash or the pyramidal Poplar, Oak, and Kikar, and having constantly been propagated from cuttings and not from seed, its characters have not varied. Regarding the character and mode of growth of the original wild forms of this species farther inquiries are needed. The names of *S. tetrasperma* (*laila*) and of *babylonica* (*majnūn*) are supposed to relate to the well-known Persian love-story, the subject of many poems (Stewart Pb. Pl. 208).

4. **S. alba**, Linn.; Hook. Stud. Fl. 337; Reichenb. Ic. Fl. Germ. t. 608.—*Common Willow. Saule blanc*, Fr.; *Weisse Weide*, Germ.

A large silky-pubescent tree with grey or whitish foliage. Leaves white beneath with adpressed silky hairs, narrow-lanceolate, denticulate; stipules lanceolate, deciduous. Flowers after the leaves, catkins on leaf-bearing peduncles. Male catkins compact, cylindric, drooping; stamens 2 rarely more, scales yellow or brown, oblong, ciliate. Female catkins lax, scales yellow, ciliate. Capsules pubescent, subsessile; style short, bifid, each branch bearing a bifid stigma.

Cultivated in Ladak, Kashmir, to 6000 ft. (Thomson Western Himalaya, 180). Western Asia, Siberia, North Africa. Europe (introduced from Asia, according to Andersson). Fl. April. Attains 70-80 ft., but is commonly cultivated in Europe as a pollard tree along streams and on moist meadows or pastures. A variety with yellow or reddish branchlets (*vitellina*) is common in Osier beds. The wood of this, as of most Willows, is white near the circumference, yellow or brown towards the centre, the medullary rays are fine and numerous, the pores are very numerous, fine and uniformly distributed. The annual rings are distinctly marked by a dark line. It is soft, and weighs 26-33 lb.

S. fragilis, L.; Hook. Stud. Fl. 336; Reichenb. Ic. Fl. Germ. t. 609—*The Crack- or Redwood Willow*, is a fast-growing moderate-sized bushy tree, extremities silky-pubescent, branchlets divergent, forming nearly a right angle with the branches, and easily broken off at the junction (whence the name). Leaves glabrous, lanceolate or oblanceolate, crenate or serrate. Flowers after the leaves, catkins generally lax, on leafy peduncles, scales long, pale-yellow, oblong-lanceolate, obtuse ciliate. Male catkins cylindric, drooping, stamens 2, free, sometimes 3-4. Capsules glabrous, short-pedicellate, narrowed into a short bifid style, each branch bearing a bifid stigma. Europe (often cultivated), Siberia, Asia Minor, Aleppo, Caucasus. One (male) specimen from Lahoul (Rev. H. Jæschke). Cultivated in Ladak with *S. alba* (Thomson l. c. 180). Wood (in Europe) yellowish red, supposed to be more durable than that of other Willows.

S. Russelliana, Sm., the *Bedford Willow*, is a variety of *S. fragilis*; by some it is considered a hybrid between *S. fragilis* and *alba*.

5. **S. elegans**, Wall.; DC. Prodr. xvi. ii. 256.—Syn. *S. Kumaonensis*, Lindl. *S. denticulata*, And.; Reise Prinz. Wald. t. 89. The following names, given in Pb. Pl. 208, partly relate to this species: *Beis*, *bitsu*, *bed*, *bida*, *beli*, *yīr*, Chenab; *Badā*, Ravi; *Bāshal*, Sutlej.

A shrub or small tree, branches glabrous, dark brown or black, the current year's branchlets, petioles, and upper side of midrib often pubescent with short hairs. Leaves elliptic- or obovate-oblong, wholly glabrous except midrib on the upper side, glaucous beneath, 2 in. long, when young membranous, afterwards hard, subcoriaceous, lateral nerves indistinct, numerous, joined by prominent reticulate veins. Flowers after the leaves; catkins slender, on pubescent leaf-bearing peduncles, scales yellow or dark brown. Male catkins compact, 1½ in. long; stamens 2, distinct, anthers short-elliptic. Female catkins 3-5 in. long, drooping, scales minute, slightly pubescent; capsules glabrous on short pedicels; styles short, stigmas spreading.

Common in the North-West Himalaya, particularly in the outer ranges from 6000 to 10,000 ft. Lahoul, Sdiling forest Kunawar, Niti Pass at 11,500 ft. Also in Nepal. Known as far north as Marri. Fl. March, April.

6. **S. hastata**, Linn.; DC. Prodr. xvi. ii. 257; Reichenb. Ic. Fl. Germ. tab. 570.

A small shrub, young shoots with long soft deciduous silky hairs, branches glabrous, dark brown or black. Leaves membranous, glabrous when full-grown, or with long soft hairs along midrib and nerves beneath, green on both sides, but somewhat paler beneath, elliptic, dentate, 1-3 in. long, ¾-2 in. broad; stipules large, broad-ovate or semicordate. Flowers with the leaves; catkins subsessile, supported by a few small leaves, scales small, brown or black, but generally entirely concealed by long white silky hairs. Male catkins cylindric, compact; stamens 2, free, anthers yellow, oblong, protruding with the shining filaments from the dense mass of long silky hairs. Female catkins somewhat lax, 2-6 in. long; capsules glabrous, often ¼ in. long, on short pedicels, terminating in a long filiform style with 2 spreading stigmas.

Inner arid Himalaya and Western Tibet, between 9000 and 15,000 ft. Baltal at the head of the Sind valley in Kashmir, head of the Butna valley below the Bardar Pass in Kishtwar, Dras, Lahoul, and the Werang Pass in Kunawar, are the outermost points where this Alpine Willow has yet been found. Alps and mountains of Central Europe, also in Sweden and Denmark. Fl. June-Aug.

This species is nearly allied to two Alpine European Willows which are also found in the mountains of Scandinavia, England, and Scotland—*S. nigricans*, Sm., and *S. phylicifolia*, Linn.; Hook. Stud. Fl. 338, 339. They flower before the leaves, the scales are less hairy, the capsule is pubescent, longer pedicellate and terminating in a long filiform bifid style, with bifid stigmas. *S. nigricans* has ovate-oblong reticulate pubescent and often rugose leaves. *S. phylicifolia* has glabrous leaves, shining above, glaucous beneath, generally elliptic-lanceolate. Both are shrubs, but often attain the stature of small trees.

7. **S. Caprea**, Linn.—**Tab. LX.**—Hook. Stud. Fl. 337; Reichenb. Ic. Fl. Germ. t. 577.—*Sallow. Saule Marceau*, Fr.; *Sahlweide*, Germ. Vern. *Bed mushk* (scented willow), Pb.

A large shrub or small tree. Leaves elliptic or obovate, crenate, glabrous above, grey-tomentose beneath, more or less rugose; main lateral nerves prominent, 8-12 on either side of midrib, with shorter intermediate ones between; stipules large, semi-reniform. Flowers appearing before the leaves; catkins densely silky, subsessile, supported at their base by a few foliaceous bracts. Male catkins ovoid-oblong, thick, about 1 in. long, erect, sweet-scented, scales dark-coloured; stamens 2; anthers elliptic-oblong. Female catkins cylindric, 2-3 in. long, nodding; scales black above the middle; capsules downy grey, ¼ in. long, cylindric from an ovoid base, on short pedicels; stigmas 2, erect, subsessile.

Cultivated at Peshawar, Lahore, Ludiana, and elsewhere in the Panjab, also in Rohilkhand. Wild throughout Europe (Lapland), in North Asia, on the Caucasus, in Asia Minor and Persia. Said to have been introduced in the Panjab from Kashmir by Hari Chand, soon after he conquered that country for Ranjit Singh, but has not been found wild there. Dr Stewart thought that it had been introduced into India by the Moguls. The leaves are shed about the end of December, and the tree is leafless until March. The flowers appear in Feb. while the tree is bare; they are collected and a scented water is distilled from them, which is mixed with sherbet and is a favourite drink of wealthy Musalmans in North India.

As grown in India, it is a small tree 25-30 ft. high, with short erect trunk 3 ft. girth. The Willow-gardens at Lahore, several acres in extent, are on low alluvial moist land near the Ravi, and consist entirely of male trees. The tree is raised from cuttings; they are irrigated occasionally, and are never pollarded. Bark dark grey or yellowish-brown, cut into irregular smooth plates by longitudinal, branching black furrows, with cracked wrinkled edges, and short cross-cracks.

In Europe the Sallow occurs generally as a large shrub, as underwood, and in coppice-woods; often a useless companion of more valuable woods in young thickets, plantations, or coppice-woods, and generally thinned out whenever possible. In Kent there were formerly large extents of coppice of this willow, for the production of hop-poles, but they have mostly given way to the more profitable Ash and Sweet Chestnut. In England it flowers about the end of March or the beginning of April, and the flowering branches of the male tree are used instead of palms in Roman Catholic churches on Palm Sunday. The bark of this and of several other Willows contains tannin, and is used for the manufacture of leather in Scotland and the north of Scandinavia. In Europe the wood is reddish near the centre; it is somewhat heavier than that of most other European species. Nördlinger gives 27-39, and Mathieu mentions a piece from Corsica of 46 lb.

8. **S. Wallichiana**, And.—**Tab. LXI.**—DC. Prodr. xvi. ii. 223.—Vern. *Bwir*, Pb.; *Bhāins*, *bhangli*, *katgūli*, N.W.P.

A shrub or small tree, youngest shoots and under side of leaves glossy with grey silky pubescence. Leaves lanceolate or ovate-lanceolate, smooth, not rugose, entire, 2-3 in. long; lateral nerves numerous, not very conspicuous. Flowers appearing before the leaves; catkins densely silky, subsessile, supported at their base by a few foliaceous bracts; scales black. Male catkins erect, cylindric, 1-1½ in. long; stamens 2, anthers elliptic-oblong. Female catkins cylindric, 3-4 in. long, drooping, scales black; capsules downy, grey, slender, ¼ in. long, short-pedicellate; stigmas 2, erect, subsessile. Distinguished from *S. Caprea* by the shape and silky tomentum of the smooth leaves and the long female catkins with slender capsules.

Afghanistan, Kashmir valley, common, also cultivated. In the plains near the Chenab. Mahassu near Simla (7000-8000 ft.) Kamaon (2500-9000 ft.) Nepal and Bhutan. Fl. March, April. Baskets are made of the branches, and twigs are used as tooth-sticks.

9. **S. daphnoides**, Vill.—**Tab. LXII.**—DC. Prodr. xvi. ii. 261; Hook. Stud. Fl. 340.—Syn. *S. pomeranica*, Willd., and *pruinosa*, Wendl.; Reich. Ic. Fl. Germ. t. 602, 603. Vern. *Bed, bidāi, betsu, beli, bushan, bashal, mudanu, shūn, thāil*, Pb.; *Yūr*, Kashmir; *Changma, chāmma, malchang, kalchang*, West Tibet.

A tall shrub, sometimes a large tree, with glabrous shining yellowish reddish-brown or nearly black branches, often covered with grey or glaucous bloom, easily rubbed off; youngest shoots slightly pubescent; buds large, ovoid-lanceolate, downy. Leaves 3-5 in. long, linear- or elliptic-lanceolate, glabrous, glaucous beneath, serrate; lateral nerves numerous, prominent. Flowers appearing before the leaves; catkins densely silky, sessile, scales fringed with long silky hairs, the upper half black. Male catkins erect, cylindric, 1-1½ in. long; stamens 2, anthers oblong, yellow. Female catkins cylindric, 2-4 in. long, nodding; capsules glabrous, subsessile, style long slender, stigmas 2, divergent, entire. The stipules of the Indian and North Asiatic form (*S. acutifolia*, Willd.) are lanceolate, of the European form they are semicordate. The leaves in the inner arid Himalaya are linear-lanceolate, in the outer ranges they are broader, elliptic-lanceolate. There is a variety with velvety branches and leaves.

Common in the inner arid Himalaya, ascending to 15,000 ft. Indus valley near Iskardo (7000 ft.), Ladak, Lahoul, Dras, Shayok, Nubra, Piti, Kunawar. Frequently cultivated (to 14,000 ft. in Ladak). Outer ranges, descending to 2300 ft. (Stewart), Kashmir (Stewart), Mahassu ridge near Simla 8000 ft. (T. Thomson), Deoban range (D.B.), Kamaon, Betali Pass at 8700 ft. (Strachey & Winterbottom). Alps and mountains of Central Europe, descending into the plains along the Rhine and other rivers; coasts of the Baltic; Russia, Siberia, Amur. Introduced to England in 1820, and run wild in Yorkshire. Planted largely, within the last 20 years, in North Germany, to fix the ground on railway embankments and cuttings, and on dry sandhills, for which its strong, long-spreading roots render it particularly suitable. Fl. March, April, later at high elevations.

Attains 60 ft. with a straight erect trunk, 6-7 and at times 9-12 ft. girth, branchlets at times pendulous. In Ladak at 15,000 ft. it is a small tree 15 ft. high and 3 ft. girth. Round gall-like knots are not uncommon on the branches. Bark usually light grey, in old trees and at great elevations often nearly black and rough with furrows. This species (according to Stewart) is much grown in Lahoul between 8500 and 11,000 ft., from cuttings 9-12 in. long, generally near water; it thrives best in light soil, where it sends down long roots. Three trees are usually planted together, and they are often bound round with cloth or branches to protect them against cattle. The twigs are used for baskets and wattles in the N.W. Himalaya. In Ladak the houses are built of willow wattle and daub. Twig bridges of willow branches are found in Piti, Zanskar, and Ladak. The wood of this and of the other species cultivated in the arid forestless inner valleys is used for building, pails, tubs, and tools. But the principal use of this and other willows in those tracts is to furnish cattle-fodder. The trees are pollarded every 3d or 4th year, at higher elevations every 5th year. This is done in spring, before the new leaves appear, the smaller twigs are given unstripped with the bark of the larger branches, the wood of these being used as fuel. In Lahoul the leaves of willows, like the leaves of most available trees, are used as litter for cattle.

S. insignis, Anders.; DC. Prodr. xvi. ii. 262—Vern. *Bitsu*, Pb.; *Gir*, Kashmir,—is a large shrub or small tree, with many strong branches, with tomentose branchlets and semicordate stipules; differs from *S. daphnoides* by hairy capsules and glabrous, large, obtuse, black scales of the female catkins. Not common. Kashmir (5000-8000 ft.), Piti (9000-12,000 ft.)

10. **S. viminalis**, Linn.; Hook. Stud. Fl. 340; Reichenb. Ic. Fl. Germ. t. 597.—*Osier*, *osier blanc*, French; *Korbweide*, German. Vern. *Bītsu.*

A shrub or small tree, young shoots with dense grey silky pubescence. Leaves linear-lanceolate, margin revolute, 4-5 in. long, pubescent or glabrate above, densely clothed beneath with soft matted silky tomentum; stipules lanceolate. Flowers before the leaves; scales of catkins brown or black at the apex, fringed with long silky hairs. Male catkins sessile, erect, cylindric, 1 in. long; stamens 2, anthers elliptic, yellow. Female catkins subsessile, cylindric, 2-4 in. long; capsules ¼ in. long, grey-tomentose, subsessile, narrowed into a long slender style, longer than the divergent stigmas. *S. Smithiana*, Willd., supposed to be a hybrid of *S. viminalis* and *Caprea*, has semicordate stipules, the leaves often broader, and style shorter than the stigmas.

Panjab, Himalaya, Jhelam and Chenab, 5000-9000 ft. Kashmir. Drās to 10,000 ft. Baspa valley, Kunawar at 9000 ft., Lahoul. *S. Smithiana* in Sikkim 5000-8000 ft. Common throughout Europe, where it is the principal and most valuable willow of Osier-beds, on account of its long and tenacious branches, in Siberia, Songaria, and on the Amur. Fl. March, April.

S. incana, Schrank; Reichenb. Ic. t. 596, has the foliage of *viminalis*, but the catkins are (not at first) pedunculate, the scales and capsules are glabrous. The stamens are more or less connate at the base. South Europe, Asia Minor.

11. **S. pycnostachya**, And.; DC. Prodr. xvi. ii. 309.—Vern. *Changma*, West Tibet.

A shrub or a small tree, young shoots silky-pubescent; branchlets violet, brown red or blackish, smooth, shining. Leaves glabrous when full-grown, lanceolate, entire or serrulate, 2-3 in. long, midrib prominent, lateral nerves numerous, oblique, not conspicuous. Flowers after the leaves, scales fringed with long soft hairs. Male catkins cylindric, nodding, on leaf-bearing peduncles; scales brown, oblong, obtuse; stamens 2, filaments connate to the apex or nearly so. Female catkins cylindric, compact, nodding, 2 in. long; scales black at the top, capsules sessile, silky (glabrous, Andersson); style short, thicker at the top, stigmas 2, broad, bifid.

At high elevations in the inner arid Himalaya, not common. Zanskar

(12,000-14,000 ft.) Ladak, ascending to 15,000 ft., often found dying at the higher elevations. Cultivated at 13,000 ft. in Ladak. Fl. May, June. The leaves turn red in Sept., before falling. Generally a shrub 6-7 ft. high, growing in clumps in dry stream-beds, at times a small tree 16 ft. high, with a trunk 2 ft. girth, and divaricate branches. Red and brown galls occur on petioles and midrib.

S. oxycarpa, And.; DC. Prodr. 310, is a monadelphous willow closely allied to the preceding sp., and only differing by the fl. appearing with or a little before the leaves; larger, more pubescent, serrate leaves; black scales of male and brown of female catkins, catkins longer and less compact, the female attaining 4 in. Kashmir and Kishtwar 6000-11,000 ft. Fl. June. *S. Ledebouriana*, Trautvetter; DC. Prodr. 308, of the Baikal and Altai mountains, in Songaria; Elbrus in North Persia, is similar to *S. pycnostachya*. *S. purpurea*, Linn. Hook. Stud. Fl. 342—Syn. *S. Helix*, Linn. Reichenb. Ic. Fl. Germ., tab. 582-585, is a glabrous shrub, with lanceolate serrate, often opposite leaves, fl. before the leaves, scales dark coloured silky, stamens monadelphous, anthers red before bursting, afterwards black, capsules short, ovoid, obtuse, sessile, stigmas subsessile, ovate. Common in Osier-beds of England, France, and Germany. Europe, North Asia, Persia, and Asia Minor. Mixed with this sp. and *S. viminalis* is often found an intermediate form, believed to be a hybrid between the two: *S. rubra*, Hudson; Reichenb. Ic. Fl. Germ. t. 586, with leaves soft-pubescent beneath, margin revolute, stigmas linear on a shorter or longer filiform style.

12. **S. angustifolia**, Willd.; DC. Prodr. xvi. ii. 315.

A low shrub, with long virgate, glabrous branches; young shoots silky-pubescent. Leaves narrow-linear, $\frac{1}{8}$ in. broad, subsessile, 1-2 in. long, midrib prominent. Flowers after the leaves in subsessile cylindric catkins, with a few leaves at their base; scales yellow, oblong, obtuse, glabrous. Stamens 2, filaments connate, bearing two 2-celled anthers. Capsules sessile, grey with silky adpressed hairs, narrowed into a short style bearing two 2-cleft stigmas.

Inner arid Himalaya, 7000-12,000 ft. Iskardo, Shayok and Nubra valley (also cultivated), Zanskar, Afghanistan. North Persia, Songaria, Caucasus, Ural. Fl. May.

Several species of Willow form small procumbent shrubs on the higher ranges of the N.W. Himalaya; the more common are: 1°. *S. flabellaris*, Anders.; Reise Prinz. Waldemar, t. 90, with obovate acute crenate leaves, blade $\frac{3}{4}$-1 in., petiole $\frac{1}{4}$ in. long, scales oblong, as long as capsules; Drās, Lahoul, Kunawar, 11,000 to 15,000 ft. 2°. *S. Lindleyana*, Wall.; DC. Prodr. 296, with small lanceolate or elliptic-lanceolate leaves, scales ovate, shorter than capsules. Kamaon (11,000-14,000 ft.), Nepal, Sikkim (at 16,000 ft.) Both are wholly glabrous, the catkins appear after the leaves on leafy peduncles, the male fl. are diandrous, the capsules glabrous, and the styles short. They are nearly allied to *S. retusa*, L.; Reichenb. Ic. Fl. Germ. tab. 558, which inhabits the Pyrenees and the Alps of Switzerland and Austria, and they are somewhat similar to *S. Myrsinites*, Linn. Hook. Stud. Fl. 341; Reichenb. t. 559, which, however, has longer cylindric catkins, hairy capsules and reticulate leaves.

2. POPULUS, Tournef.

Leaves broad, rarely lanceolate or linear; petioles generally exceeding one-fourth the length of leaf, the leaves of shoots and suckers often differently shaped. Scales of catkins caducous, obovate or rotundate, crenate lobed or cut. Disc flat or cup-shaped, often oblique, membranous or thick and slightly fleshy. Stamens 4-30, inserted on the disc, filaments generally less than twice the length of anthers. Stigmas 2-4, often lobed. Capsule 2- 3- or 4-valved, with the valves spreading, each valve bearing a placenta along its median line.

Capsule 2-valved.	
Buds viscid; leaves and catkins glabrous	1. *P. nigra.*
Buds hairy; leaves white-tomentose beneath, catkins hairy	2. *P. alba.*
Capsule generally 3- or 4-valved, rarely 2-valved.	
Capsule pedicellate; leaves of different shapes, some linear, others broad-ovate, cut and lobed	3. *P. euphratica.*
Capsule pedicellate; leaves cordate, ciliate . . .	4. *P. ciliata.*
Capsule subsessile, rugose; leaves ovate, not ciliate . .	5. *P. balsamifera.*

1. **P. nigra**, Linn.; Hook. Stud. Fl. 335; Reichenb. Ic. Fl. Germ. t. 619. *Black Poplar.*—Vern. *Sufēda*, Pb. plains; *Frast*, Kashmir; *Prost*, *farsh*, *makkal*, Chenab; *Kramali*, *biūns*, *do*, Sutlej; *Yarpa*, *yūlatt*, *kabūl*, Ladak. (*Safēdār* is the Persian for Poplar.)

A large glabrous tree with spreading, or (in N.W. India always) erect branches, forming a narrow cylindric crown (*P. pyramidalis*, Rozier—Syn. *P. fastigiata*, Desf., the *Lombardy Poplar*). Buds viscid. Leaves glabrous, subcoriaceous, broad-ovate rhomboid or almost triangular, nearly as broad as long, crenate and acuminate; blade 2-4, petiole 1-2½ in. long; 3 basal nerves, midrib penniveined. Male catkins compact, red, glabrous, stamens 15-30. Female catkins glabrous, lax, drooping, disc shallow, indistinctly dentate, pedicel shorter than cup; stigmas 2, subsessile, broad, obcordate. Fruiting catkins 4-6 in. long; capsules 2-valved (always?) pedicels shorter than capsule.

Planted in the N.W. Himalaya, particularly in Kashmir, and in the basins of the Jhelam, Chenab, and Sutlej rivers (Kunawar to Spui and Dabling), between 3000 and 11,500 ft., in Ladak as high as 12,500 ft. Occasionally planted in the plains, at Lahore, Peshawar, Hushiarpur, and elsewhere. Nearly always the cupressiform or pyramidal variety. The tree is common in Afghanistan (wild, according to Griffith, at Shekkabad, near Kabul, at 7500 ft.) The spreading variety is wild in Europe (naturalised, not indigenous in England), and throughout North and West Asia. C. Koch (Dendrologie, ii. 489) states that in Hungary, South Russia, and Asia Minor, the tree has more erect branches, forming an elongated crown, similar to that of the Lombardy Poplar. The latter has long been cultivated in Italy; it is not, however, mentioned by classical writers, and must have been brought from Asia by the Arabs, or at a later period. From Italy it was introduced into France in 1749 (Mathieu), and into England in 1758 (Loudon). Like the Weeping Willow, it has maintained its peculiar characters unaltered, having always been propagated from cuttings. Most of the Lombardy Poplars in Europe are male; the female tree of it is known, but scarce. In India the tree does not often flower, but specimens in young fruit (collected in Kashmir by T. Thomson) are in Herb. Kew. The tree is leafless in winter, and the leaves turn yellow before being shed. The pyramidal Poplar in N.W. India has the same shape, and attains the same size (90 ft. high, 6-8, sometimes 10-12 ft. girth) as the Lombardy Poplar in Europe ; it is generally planted as an avenue-tree—a very fine specimen of a poplar avenue is the one near Sirinagar in Kashmir, about a mile long, perfectly straight, lining a road which runs east and west across the fine grassy plain towards the Takhti Suliman. Dr Stewart estimated the number of trees at 1700; they are 90-105 ft. high and 6-7 ft. girth, many of the trees with dry branches at the top. In Ladak the trees do not exceed 50-60 ft.

The Lombardy Poplar, when old, has a furrowed and often twisted trunk; the bark is grey, rough with numerous vertical cracks and fissures. The wood is whitish brown, near centre very soft and light, even-grained ; its structure is similar to that of *P. alba.* The weight of the Lombardy Poplar wood is between 24.9 and 27.4 lb., that of the round-headed black Poplar 24.3 to 32.4 lb. per cub. ft. (Nördlinger). In Afghanistan it is, like the white Poplar, used for grape-boxes. In Europe the wood of the black Poplar is used for planking, packing-cases, wooden shoes, and (in Italy) for window-blinds. Paper is also made of it. The wood of the Lombardy Poplar, which is often knotty, is (in France) sometimes used for veneering. The black Poplar pollards well. Both kinds are rapid growers ; the black Poplar attains 80 ft. and a diam. of 2 ft. in 50 years ; they are always propagated from cuttings ; the black Poplar is useful to fix the soil on slopes too dry for the Willow. In India the tree is often lopped for cattle-fodder.

2. **P. alba,** Linn. ; Hook. Stud. Fl. 335 ; Reichenb. Ic. Fl. Germ. t. 614. —*White Poplar, Abele. Silber pappel,* German ; *Peuplier blanc,* French. Vern. *Sperdor, spelda,* Afg. ; *Chitta* (white) *bagnu, safedar, jangli frast, fras, prist, rīkkan, sannūn, chanūn, māl,* Pb.

A large tree, the current year's branchlets, buds, petioles, and under side of leaves with dense white, soft, cottony tomentum. Leaves ovate, with obtuse sinuate lobes, those of luxuriant shoots deeply 3-5-lobed, blade 2-4, petiole 1-2 in. long, basal nerves 5, the midrib penniveined. Catkins hairy ; male flowers 4-10-androus. Female catkins : disc shallow, entire, stigmas apparently 4, really 2, each of 2 linear lobes. Pedicels longer than disc and shorter than ovary. Capsule short-pedicellate, 2-valved.

Wild and cultivated in the N.W. Himalaya between 4000 and 10,000 ft., on the Jhelam, Chenab, and (planted only) in Kunawar above Miru and Poari, on the Shayok in Chorbat as high up as Turtuk (9200 ft.) Planted in the Peshawar valley, the trans-Indus territory, in the Panjab plains (not common), and in Sindh. Wild and planted in Afghanistan, Beluchistan, North Persia, Caucasus, Siberia, Songaria, Europe, North Africa. Flowers in early spring, before the leaves ; these come out in March (in the plains). In India a moderate-sized tree, 30-40 ft. high, girth 6, rarely 8 ft. In Europe often attains 100 ft., with a tall straight stem 50-60 ft. long, and a diam. of 6-10 ft. Bark ½-⅔ in. thick, light- or yellowish-grey, smooth when young, getting darker and rough when old. Wood white, with a reddish tinge, brown near the centre, soft and light, but even-grained. Not much valued in India. In Afghanistan the shallow round boxes in which grapes are packed for export to India are made of the wood of this species and of *P. nigra.* The wood has numerous very fine medullary rays, and numerous small pores uniform in size and uniformly distributed, annual rings fairly distinct. Weight 25-35 lb. (Nördlinger). In Europe the wood is much in request for packing-cases, the bottom planks of carts and waggons, for turning, and toys. In India it is generally raised from cuttings, often of large size. The growth is rapid; the tree (in Europe) attains a diameter of 2-3 ft. in 50 years (according to Mathieu, a diam. of 2 metres in 40 years). Like most Poplars, it sends up abundant root-suckers. The Indian tree does not often flower, specimens in fruit, collected in W. Tibet by T. Thomson, are in Herb. Kew. Dr Stewart states that he never saw a tree in flower or fruit.

P. canescens, Sm., the *Grey Poplar* of Europe, leaves hoary, and afterwards glabrous beneath, is by Hooker classed as a sub-species under *P. alba*. The wood takes a good polish.

P. tremula, Linn.; Hook. Stud. Fl. 335; Reichenb. Ic. Fl. Germ. t. 618—the *Aspen—Tremble*, French; *Aspe, Zitter pappel*, German; belongs to the same group as *P. alba*, with 2-valved capsule and pubescent buds. The leaves are pubescent when young, almost orbicular, on long slender pedicels, dentate with large obtuse teeth, the leaves of shoots and suckers are different, larger and short-petiolate, Europe, North and West Asia, Africa. A moderate-sized, sometimes a large tree, spreads widely by means of root-suckers, and is often very inconvenient in coppice-woods and thickets of hardwood trees. The wood is white, and of late has been much sought after for the manufacture of paper. Burckhardt, in his excellent work, "Säen u. Pflanzen," 451, states that in the north-eastern Harz forests the price of this wood has increased sevenfold within a short time on that account.

3. **P. euphratica**, Olivier.—**Tab. LXIII.**—DC. Prodr. xvi. ii. 326.—Syn. *P. diversifolia*, Schrenk. Vern. *Bāhan, bhān, jangli benti, safedar*, Pb.; *Bahn*, Sindh; *Patki*, Brahui; *Hodung*, Ladak.

A large glabrous tree, extremities sometimes hoary; buds slightly pubescent, not viscid. Leaves coriaceous, most variable in shape, those of seedlings, young trees and luxuriant shoots, pollard- and coppice-shoots, linear, short-petiolate, 3-6 in. long, those of older trees and on branches with short internodes, generally broad-ovate rhomboid or cordate, blade 2-3 in. long and equally broad, often broader than long; petiole 1-2 in. long. The broader leaves have generally the upper half dentate, cut or lobed, they have also 3-5 basal nerves, and the midrib penniveined; the narrow leaves are entire, without prominent lateral nerves. All kinds of intermediate forms are frequently seen on the same tree, and on the same branch the lower leaves are often broad, and the upper narrow, lanceolate. (In Tibet the leaves vary much less than in the plains of the Panjab.) Catkins lax, nodding. Male fl.: scales oblanceolate; disc on long slender pedicels, flat, 8-cleft; stamens 8-12, anthers oblong, quadrangular, longer than filaments. Female fl. pedicellate, disc membranous, caducous, tubular with 8-12 linear segments; stigmas 3, more or less irregularly crescent-shaped, narrowed into short styles. Capsule lanceolate, opening into 3, rarely 2 valves, $\frac{1}{4}$-$\frac{1}{2}$ in. long; pedicel slender, shorter than capsule.

Common in the forest belt of Sindh along the Indus, particularly in upper and middle Sindh, where its seedlings spring up in abundance, some time after the annual floods have receded, on the fresh alluvial deposits (Katchas) which are formed every year by the action of that river. There the Poplar forms standard trees over the underwood of Tamarisk (p. 22). Not uncommon in the valleys of the Suliman range to 3000 ft. on small feeders of the Indus, and also found in nooks and corners along the main river between Dehra Ismail Khan and Attok. Higher up the Indus and its feeders, it is known in Ladak, it is common in Nubra along the Shayok river, growing in pure sand (Thomson, West. Him. 191). Dr Stewart mentions a tract along the (Nubra ?) river at 10,500 ft. almost a mile long, covered by it, a plot of over a score of trees at 12,000 ft., and an occasional tree at 13,500 ft. The tree is also wild in the Southern Panjab (female more common than male trees), forming thickets along the lower course of the Sutlej river, about Multan and between the Sutlej and Indus. It has not been found, however, wild on any of the other Panjab rivers in the Himalaya or along their upper course in the plains. It has been reported from Lahoul; but Dr Stewart, who botanised over both branches of the Chenab in that district, the Chandra and Bagha, to the upper limit of trees, never found it, nor was it reported by the Rev. H. Jæschke. It is commonly planted in gardens and on roadsides in the plains of the Panjab, and thrives well. The tree is indigenous in Afghanistan (abundant near Kandahar), in Songaria, on the Sir Daria in Turkestan (Fedtschenko), in Kurdistan, on the Euphrates and Tigris, between Shiraz and Aboushir in Persia, in Central Arabia, along the river Jordan in Palestine, and along ravines in the hills of Oran in Algeria (Bourgeau). On the banks of rivers, which form its principal habitat, the tree is often gregarious. It is nearly leafless from Jan. to March, and flowers in Feb., the seeds ripening between April and June. While in flower it is either leafless or with a few old leaves left.

In the Sindh forests the tree attains 40-50 ft., and a girth of 5-8 ft.; the trunk is regularly shaped, but not very straight. In Ladak it is 20 ft. high, with a girth of 3-4 ft. Bark ½ in. thick, marked with irregular vertical furrows; inner bark fibrous. Where the tree is subject to inundation, the lower part of the trunk often gets covered with short horn-like roots, similar to what is seen on Willows, and from the wood of the trunk short hard spine-like processes are often found projecting into the inner part of the bark, as in *Ulmus* (p. 434). The wood is harder and more compact than that of the preceding species; the outer wood is whitish, the inner reddish with dark-brown veins, nearly black in old trees. The medullary rays are fine, numerous, the pores are much larger than in *nigra* and *alba*, they are uniformly distributed, solitary or in groups of 2-5. In the South Panjab the wood is only used for the lining of walls, but in Sindh it is employed largely for beams, rafters, panelling, and turnery. Most of the lacquered Sindh boxes are made of this wood. On the Euphrates and Tigris it is also used for planking and boat-building. It is employed as fuel for domestic use in Sindh and the South Panjab. The heating powers are not great, and it is therefore not much used for the river steamers; but in Ladak, where fuel is very scarce, it is much prized. The leaves furnish fodder for goats and cattle, and the tree is lopped occasionally for that purpose both in the plains and in Tibet. Gun-match is made of the inner bark in Sindh, and the bark is given as a vermifuge. The tree grows rapidly (3-4 rings per in. of radius), the annual rings are often unequal in width; it throws out numerous root-suckers, and becomes troublesome in gardens. It coppices vigorously; in Sindh coppice-shoots are often used for rafters, and it bears pollarding for a long time.

4. **P. ciliata**, Wall.; Royle Ill. t. 84^{a}. Vern. *Sufeda, bagnu, phalja, phlassu, falīs, phalsh, ban phrastu, dud phras, asān, suāli, rīkkan, saki, pābe, chanūn, krammal*, Pb.

A large tree, with lanceolate, viscid, resinous buds, the yellow resinous gum sometimes secreted in masses; young shoots slightly pubescent. Leaves pale and pubescent along nerves beneath, cordate, acuminate, dentate, with obtuse, glandular, ciliate teeth, otherwise glabrous, blade 3-7, petiole 2-5 in. long; basal nerves 3, the midrib prominent, penniveined. Female catkins drooping, compact while in flower, lax in fruit. Disc large, enclosing more than half the ovary, dentate with rounded obtuse teeth, pedicel shorter than disc, but lengthening out in fruit. Stigmas 3-4, large, obcordate, subsessile. Fruiting catkins 6-9 in. long, pendulous; capsule ovoid, $\frac{1}{4}$-$\frac{1}{3}$ in. long, 3-4-valved, each valve bearing a placenta on a black median line; hairs of seeds as long as capsule; pedicels as long as capsule.

Himalaya, at 4000-10,000 ft. from the Indus to Bhutan in mixed forests, most common north-west of the Jumna. In Kunawar, Rarang is its upper limit; it is not uncommon near Chini and Pangi, but there is no proof of its having been found in the inner arid tract either on the Sutlej or on the Indus. It has not been found trans-Indus, but Dr Stewart thought that it would probably be found higher up on the Suliman range than where he had been, and in his MSS. he entered *Shāwa* as the Pushtu name of the tree. The leaves are shed in October, and turn light yellow before falling; the new leaves come out early in spring, with or soon after the flowers. Attains 60-70 ft., with a tall, erect straight trunk, 6-8, occasionally 10 ft. girth, often ridged and almost buttressed. Bark grey, smooth with vertical wrinkles. Galls, brittle, brown, subglobose, 1 in. diam., are often found on young branches. The leaves somewhat resemble those of *Ficus religiosa*, and the tree is sometimes called *pahari pipal*, with the least breath of wind they make a continuous fluttering noise. The wood is soft, white; water-troughs are made of it. The leaves are valued as fodder for goats.

5. **P. balsamifera**, Linn.—Syn. *P. suaveolens*, Fisch., and *laurifolia*, Ledebour Fl. Ross. iii. 629. Vern. *Phalsh*, *makkal*, *pakhshu*, *pakh būt*, *kramal*, Pb. *Berfa*, *changma*, *yarpa*, *magkal*, *māhal*, West Tibet.

A large tree, with long, angled, flexuose, graceful branchlets and viscid resinous buds, youngest shoots slightly pubescent. Leaves often crowded at the ends of short lateral branchlets, subcoriaceous, glabrous, pale, often tawny beneath, ovate, acuminate, dentate, blade 2-5, petiole 1-3 in. long. Male catkins cylindric, drooping, rachis angular, slightly winged; disc pedicellate; stamens 20-30, filaments slender, longer than anthers. Female catkins lax, drooping, 5-6 in. long when in fruit; rachis generally hairy. Disc cup-shaped, or turbinate, sinuate-dentate. Ovary rugose, often hairy; stigmas 2-3, broad, 2-lobed. Capsule subsessile, girt at base by the glabrous yellow disc, 2-4-valved, each valve bearing a placenta on the inside along its median line.

Commonly planted in the inner arid N.W. Himalaya. Lahoul (9000-10,800 ft.), Kunawar (8000-9000 ft.), Piti (10,000-13,000 ft.), Zanskar, Ladak (to 14,000 ft.) Wild on the Shāyok in West Tibet, and throughout North Asia and North America (*Tacahamac* tree). Also in Afghanistan (Hyderkhet, on the Schneesh river, Stewart). Hardy in England. Fl. April-May; the fruit ripens in Aug. and Sept. Attains (in Tibet at moderate elevations) 60-70 ft., and a girth of 6, sometimes 9 ft. Trunk not very tall, often gnarled when old, crown broad rounded, or more frequently long, oval, sometimes approximating to the cypress shape. Bark thick, furrowed and rough, dark grey. Galls are common on leaves and branches. Leaves and branchlets are full of balsamic juice, which stains paper; balsam also exudes on a fresh cut between bark and wood. The trees are often lopped for cattle-fodder. A tincture prepared from the buds has been used medicinally in North America.

Order LXXII. CUPULIFERÆ.

Trees, rarely shrubs, with scaly buds and alternate simple leaves with deciduous stipules. Flowers monoicous. Male flowers in bracteate spikes, catkins or heads, rarely solitary. Perianth none, or consisting of 5 or more lobes or leaves. Stamens 5, or more, rarely fewer; anthers 2-celled. Female fl.: 1 or several enclosed in an involucre of free or more or less connate bracts. Perianth adnate to ovary, limb minute, indistinct, or more or less regularly toothed. Ovary inferior, generally 2-3-, in a few cases more -celled; styles as many as cells. Fruit indehiscent, generally 1-seeded, more or less enclosed in the enlarged foliaceous or hardened involucre. Seed large, solitary, rarely 2 or 3; testa thin; albumen none; cotyledons thick, fleshy, farinaceous or oily; radicle short, superior.

Male flowers in heads or in lax interrupted catkins or spikes; perianth of 4-10 lobes or leaves; anthers 2-celled, cells connate; ovary 3-7-celled, 2 collateral ovules in each cell. (Order *Cupuliferæ* of most authors.)	
Fruit a gland (acorn), solitary, 1-seeded, the lower part (rarely the entire acorn) included in a cup of imbricate scales or concentric belts	1. Quercus.
Fruit of 1-3 generally 1-seeded nuts, enclosed in a thick coriaceous prickly involucre, opening irregularly . .	2. Castanopsis.
Male flowers in dense cylindrical drooping catkins; perianth none; stamens inserted on the base or inside of a broad scale; anthers 1-celled, or 2-celled with distinct cells; ovary 2-celled, one ovule in each cell. (Order *Corylaceæ* of most authors.)	
Fruit small, 1-seeded, in the axil of large foliaceous bracts in drooping spikes	3. Carpinus.
Fruit a large 1-seeded nut, enclosed in a large cut and lobed, sometimes spinescent, sheathing involucre . .	4. Corylus.

1. QUERCUS, Linn.

Deciduous or evergreen trees, with entire or serrate, coriaceous or subcoriaceous leaves. Male flowers in drooping catkins or erect spikes. Perianth 3-8-lobed, stamens as many as lobes, or more numerous; anthers hairy or glabrous, cells connate. (A rudimentary ovary in subg. Pasania.) Female flowers in clusters or spikes, rarely solitary, each flower enclosed in an involucre of numerous bracts, which in fruit form a cup, and are either imbricate or connate into concentric belts. Limb of perianth minutely toothed. Ovary 3-celled, with 2 ovules in each cell; styles 3, stigmatose along the inner surface or at the apex only, often red. Fruit a gland (acorn), with a coriaceous pericarp, 1-seeded, the rudiments of the abortive ovules at the base or the top of the seed. The cotyledons are thick fleshy, as a rule farinaceous, in a few cases oily (candles are made of the acorns of an oak in New Grenada).

Of this large genus 281 sp. are described in De Candolle's Prodromus. A. S. Œrsted, in his introduction to "Liebmann, Chênes de l'Amérique tropicale," 1868, proposes to divide it into 4 genera, with the following diagnostic characters, three of which contain species described below:—

Styles stigmatose along the inner surface; male flowers in drooping catkins; leaves generally serrate or lobed.
Scales of cup imbricate . . . . . . 1. QUERCUS (1-15).
Scales of cup in concentric belts . . . 2. CYCLOBALANOPSIS (16,17).
Styles stigmatose at the apex only; male flowers in erect spikes; leaves entire.
Scales of cup imbricate . . . . . . 3. PASANIA (18).
Scales of cup in concentric belts . . . 4. CYCLOBALANUS.

Under this arrangement the species of *Quercus* are American, European, and West Asiatic, whereas the species of the other genera are confined to Eastern Asia and the Indian Archipelago, with one exception, *Pasania densiflora*, Œrst. of California. The following clavis includes (in brackets) the more important European and West Asiatic Oaks.

Leaves serrate dentate lobed or pinnatifid; male fl. in pendulous catkins, without rudimentary ovary.
Cup with imbricate scales, adpressed or spreading (*Quercus*, Œrsted).
Scales closely adpressed in the ripe fruit, more or less connate at base.
Leaves persistent until winter, generally beyond the appearance of the new leaves; styles linear or linear-clavate.
Full-grown leaves tomentose or pubescent beneath.
Acorn globose, supported at the base by a flat or slightly concave cup; main lateral nerves 8-12 pair, bifurcating . . . . . . 1. *Q. semecarpifolia.*
Acorn cylindrico-conical, the lower half or third part enclosed in a hemispherical cup.
Main lateral nerves 6-12 pair, not prominent . 2. *Q. Ilex.*
Main lateral nerves 10-20 pair, prominent.
Leaves 4-8 in. long, rusty or tawny-tomentose beneath; main lateral nerves 10-16 pair 3. *Q. lanuginosa.*
Leaves 3-6 in. long, grey-tomentose beneath; main lateral nerves 14-20 pair . . 4. *Q. incana.*
Full-grown leaves glabrous on both sides . . 5. *Q. dilatata.*
Leaves deciduous in autumn; styles short, thick, clavate, and often lobed.
Leaves dentate, deeply lobed or pinnatifid; main lateral nerves 6-12 pair.
Leaves glabrous, short-petiolate, with auriculate base; fruit pedunculate . . . . . (6. *Q. pedunculata.*)
Leaves pubescent beneath, narrowed into petiole; fruit sessile . . . . (7. *Q. sessiliflora.*)
Leaves velvety beneath, pubescent above; fruit short-pedunculate . . . . . . (8. *Q. Toza.*)
Leaves dentate, main lateral nerves 10-14 pair . (9. *Q. lusitanica.*)

Scales free, spreading or reflexed in the ripe fruit; styles linear, acute or subulate.
Main lateral nerves 6-10 pair; leaves dentate lobed or pinnatifid.
Branchlets glabrous; leaves deciduous in autumn (in some varieties later), pubescent beneath . (10. *Q. Cerris.*)
Branchlets tomentose; leaves deciduous in spring, tomentose beneath . . . . . . (11. *Q. Ægilops.*)
Main lateral nerves 6-10 pair; leaves persistent, dentate, tomentose beneath.
Fruit on the current year's shoots . . . (12. *Q. Suber.*)
Fruit on the previous year's shoots . . . (13. *Q. occidentalis.*)
Main lateral nerves 14-16 pair, each nerve terminating in a long fine subulate serrature; leaves deciduous . . . . 14. *Q. serrata.*
Main lateral nerves indistinct; leaves persistent, glabrous when full-grown, with spinescent teeth (15. *Q. coccifera.*)
Cup with concentric belts (*Cyclobalanopsis*, Œrsted).
Leaves pubescent beneath, 3-6 in. long; main lat. nerves 10-14 pair . . . . 16. *Q. annulata.*
Leaves glabrous, white beneath, 6-12 in. long; main lat. nerves 20-25 pair . . . . . . 17. *Q. lamellosa.*
Leaves entire; male fl. in erect spikes; stamens surrounding a rudimentary ovary (*Pasania*, Œrsted) . . . . 18. *Q. spicata.*

According to A. De Candolle, the abortive ovules are in spp. 1-15 at the base of the fruit, generally attached to a more or less elongated placenta, but in *Q. spicata*, and probably in *Q. annulata* and *lamellosa*, at the top of the fruit.

1. **Q. semecarpifolia**, Smith.—**Tab. LXIV.**—Wall. Pl. As. Rar. t. 174.—Vern. *Barchar, jangal ka parūngi*, Jhelam; *Kreu, khareu, krūi*, Chenab, Ravi; *Karshu, karsūi, karzu, sāuj*, Sutlej to Sarda; *Ghesi*, Nepal.

A large tree, leafless for a few weeks in spring, the spring shoots catkins and young leaves with soft hairs. Leaves coriaceous, rigid, glabrate above, densely clothed beneath with ferruginous tomentum, very variable in shape, subsessile or short-petiolate, elliptic- or obovate-oblong from cordate base, obtuse, 2-5 in. long, entire or dentate with long, subulate, spinescent teeth, main lateral nerves 8-12 pair, generally bifurcating and branching at half their length, prominent beneath, and impressed on the upper side of leaf. Male flowers in drooping slender catkins 2-3 in. long, the catkins generally fasciculate, from the base of the spring shoots, or from the axils of fallen leaves on the previous year's branchlets. Bracts broad-ovate, ciliate. Perianth-segments obtuse, ciliate; stamens 6-18, anthers glabrous, apiculate. Female flowers in short-pedunculate spikes; styles 3-5, elongate, linear, recurved. Scales of cup membranous, brown, ovate-lanceolate, obtuse, softly hairy. Acorn globose, 1 in. diam., glabrous, black or dark brown when ripe, supported, but not enclosed, by the small, concave cup; the ripe acorns on the current year's wood. The leaves of young trees or young shoots are generally dentate, but entire and dentate leaves are not rarely found on the same branch.

Safedkoh at 10,000 ft. N.W. Himalaya, mostly on north and north-west slopes, between 8000 and 10,000 ft., occasionally descending to 6000 and ascending to 12,000 ft. Nepal, Bhutan. Leafless for a short time in April and May, the flowers generally appear with the fresh leaves, sometimes in June; the fruit ripens in August, and soon falls to the ground, where it often germinates within a few days. Generally gregarious, often covering considerable areas to the exclusion of almost every tree of other kinds, not rarely forming the upper limit of forest vegetation. Attains a larger size than any oak of the N.W. Himalaya. Trees 70-80 ft. high, with 7-8 ft. girth, are not rare; they often attain 12 ft., and Dr Stewart measured one 15 ft. girth at 5 ft. from the ground, the trunk bifurcating at 10 ft. In Nepal, Wallich mentions 80 to 100 ft., with a girth of 14-18 ft., as common dimensions. Where the young trees have grown up close together, the *Karzu* has an erect, straight trunk, clear of branches. The growth of the tree is generally slow, 10-15 rings per in. of radius. Bark grey, cut by shallow cracks into small four-sided scales, with truncate corners. Wood greyish-brown, hard and heavy, medullary rays fine and numerous. In the hills it is used for building, door-frames, bedsteads, carrying-poles, helves, and ploughs, but it is said to warp and to be liable to be eaten by insects. Owing to the remote localities where it mostly grows, and to its great weight, it has not been exported to the plains. Yields excellent charcoal. The leaves are commonly stored as winter fodder for cattle.

2. **Q. Ilex**, Linn. *Holm Oak—Yeuse*, Fr.; *Leccio*, It.—Syn. *Q. Baloot*, Griff.; DC. Prodr. xvi. ii. 38. Vern. *Charrei*, *serei*, *balūt*, Afg.; *Spercherei*, *pargāi*, *kharanja*, Trans-Indus; *Chūr*, *kharsu*, *khareu*, *irri*, *yūru*, *yiri*, *heru*, (*kathūn*)*ban*, *bre*, *brekche*, Pb.

A middle-sized evergreen tree, often only a shrub, the shoots of the current year pubescent, with grey stellate hairs. Leaves 2-3 in. long, coriaceous, exceedingly variable in shape, elliptic or oblong, entire, or with large spinescent teeth, petioles and under side clothed with soft grey tomentum, upper side at first pubescent with stellate hairs, afterwards glabrate, main lateral nerves 6-12 pair, not prominent. Male flowers in slender drooping catkins, the catkins in axillary fascicles, perianth somewhat irregularly divided into 4-5 membranous ciliate segments. Anthers (in the Indian specimens) hairy, shortly and obtusely apiculate. Ovary conical, soft-tomentose, exserted; styles 3-5, linear-clavate, spreading, surrounded at the base by the acute, more or less distinct scales of the perianth. Fruit pedunculate, rarely sessile, generally 2-3 acorns at the end and angles of a flexuose peduncle, shorter than the leaf. Acorns at first nearly enclosed in the campanulate or turbinate cup, when mature cylindric with conical top, light brown, glabrous, shining; scales of cup closely adpressed, hoary, base ovate, narrowed into a linear or lanceolate apex, the ripe acorns on the current year's wood. A variety with eatable seed is *Q. Ballota*, Desf. Th. Kotschy (Die Eichen Europas u. d. Orients, t. 38) describes and figures the anthers of *Q. Ilex* as glabrous, but there are specimens from Greece and other parts of the Mediterranean with hairy anthers. It is a matter for farther inquiry whether in this section of *Quercus* this is a good specific character. The Indian and Afghanistan specimens have densely hairy anthers, and short nearly oval leaves.

North-East Afghanistan, Kaffiristan, on the Safedkoh, ascending to 10,000 ft. Abundant on the eastern flank of the Suliman range (5000-6500 ft.) Hills north of the Peshawar valley at 3500 ft. Arid tracts of the inner Himalaya, on the upper Jhelam, Chenab, Ravi, and Sutlej, generally between 3000 and 8500 ft. In Kunawar its lower limit is Chergāon and Panwi, its upper Teling and Purbni. The Holm Oak is also indigenous in the entire Mediterranean region, extending in the west of France north to the Loire, and in a few places even farther (Sarthe, Finisterre). Forms extensive forests in Provence, Algeria, Spain, Sicily, Corsica (in the region of *P. Pinaster*, above the zone of *Phillyrea*, *Arbutus*, *Pistacia*, and below the forests of *Pinus Laricio*). It is known from Asia Minor, near the Black Sea, and De Candolle quotes it from Palestine; but as far as known at present there is a gap in its range of distribution between the Mediterranean region and Afghanistan, which seems to favour the maintenance of Griffith's species, *Q. Baloot*. There is, however, no essential character separating the Indian from the Mediterranean tree, and I therefore follow T. Thomson, who first identified them (Western Himalaya, 73). The tree was introduced into England in 1581, is commonly planted, and attains a large size. In favourable seasons the acorns ripen regularly at Kew. It is hardy in south-west Germany, not in the north and north-east. Fl. April-May. In France the fruit ripens in Sept. (Mathieu), in England in Nov. In Europe the leaves remain two years on the branches. Gregarious, but not often forming dense or pure forests; in N.W. India sometimes associated with *Olea*.

In India generally attains 20-40 ft., with a short straight trunk 5-6 ft. girth, but is often seen of larger size. In Afghanistan it is often a large shrub, and in central France it grows in the same manner. It is a slow-growing tree, but coppices vigorously; there are extensive coppice-woods for fuel and bark in the south of France (*e.g.*, near Draguignan). Seedlings have a long straight tap-root. The bark is light- and dark-grey, often nearly black, tesselated and cut into quadrangular plates by wavy longitudinal furrows and straight transverse smaller cracks, somewhat resembling the bark of *Reptonia buxifolia*. Sapwood small, whitish, heartwood dark-brown, often mottled or with darker patches, and in old trees the centre wood often reddish-brown or nearly black, the annual rings indistinct. Pores small, medullary rays very broad (⅓-½ line), giving an irregularly reticulate appearance on a vertical section. The wood is clōse-grained, very hard and heavy; the weight of the European tree varies between 60 and 69 lb. per cub. ft. It warps, twists, and splits much in seasoning, but takes a fine polish. Ploughs and other agricultural implements are made of it where it grows in the N.W. Himalaya; and quantities are imported into the western Panjab from the Suliman range, in the shape of short cylindrical pieces, called *Kharanja ka bāzu* (arms of oak), to be made into tool-handles. The wood is excellent fuel, and much of the fuel used in Peshawar consists of it. It yields good charcoal. Fences are made of the branches with prickly leaves, and those without prickles are stored for winter fodder. The acorns are said to be a favourite food of the large white-faced monkey (Langūr): the acorns of the sweet variety form an important article of food in Spain and Algeria.

It is not improbable that part of the oak-galls of the Panjab bazaars (*mājū*), which are given medicinally as an astringent, and used for dyeing the hair, are from this species.

3. **Q. lanuginosa**, Don Prodr. Fl. Nep. 57.—Syn. *Q. lanata*, Wall. Vern. *Ranj*, *rīanj*, *rāi banj* (King of Oaks), Kamaon; *Banga*, Nepal.

A large evergreen tree; spring shoots and young leaves densely clothed with thick soft rust-coloured or tawny tomentum. Leaves coriaceous, oblong-lanceolate, dentate with distant obtuse triangular teeth, upper side glabrous, shining, under side densely clothed with thick soft tawny or rust-coloured tomentum; midrib and main lateral nerves 10-16 pair, prominent beneath, impressed on the upper side of leaf, blade 4-8, petiole ½-1 in. long; stipules ovate or oblong, middle part hairy, edge thinly membranous. Male fl. densely clothed with long soft hairs, in slender drooping catkins, bracteoles acute ciliate. Perianth irregularly divided into 4-5 short lobes; anthers glabrous, shortly and obtusely apiculate. Female fl. densely tomentose, styles linear. Acorns sessile, solitary or in pairs, on the current year's wood, cup hemispherical, with adpressed ovate scales.

Naini Tal and a few other places in Kamaon, between 6000 and 7500 ft. Nepal; Bhutan. Fl. April, May; fr. Oct., Nov. Gregarious, often associated with *Q. incana*, attaining 70-80 ft., with a straight erect trunk. The leaves are used as cattle-fodder.

4. **Q. incana**, Roxb. Fl. Ind. iii. 642.—Vern. *Bān, bānj, banj*. Local names: *Vari*, Salt range; *Rīnj, rīn*, Jhelam.

A middle-sized or large evergreen tree, with grey foliage, the current year's shoots and petioles hoary. Leaves coriaceous, oblong-lanceolate, serrate with sharp mucronate teeth, glabrous above, densely clothed beneath with short white tomentum; main lateral nerves 14-20 pair, prominent beneath, blade 3-6, petiole ½ in. long; stipules linear. Male fl. pubescent with soft white hairs, in slender drooping catkins, bracteoles obtuse, longer than perianth. Perianth irregularly divided into 4-5 short lobes; anthers glabrous, shortly and obtusely apiculate. Female fl. axillary, sessile, generally in clusters of 2-5; styles linear-clavate, spreading. Acorns on the current year's wood, sessile or subsessile, cup at first almost entirely enclosing the acorn, afterwards campanulate, enclosing half the acorn, which is at first tomentose, afterwards glabrous, brown and shining; scales rough, closely adpressed.

Outer Himalaya from the Indus to Nepal, generally between 3000 and 8000 ft.; not in the Kashmir valley or the surrounding hills, and not in the arid tracts. Its upper limit in the Sutlej valley is opposite Chergaon. Gregarious, often associated with *Rhododendron arboreum* and *Andromeda*. The leaves are generally renewed in March and April, the flowers appear about the same time, the acorns commence to ripen in August, and frequently remain on the tree until the young fruit of the ensuing year appears. Attains 50-60 ft., with a short straight trunk 6-8 ft. girth (12 ft. has been noted), but at lower elevations it does not generally exceed 30 ft. and 4-5 ft. girth. It can be grown in the plains (Saharanpur). Bark dark-coloured, rough with cracks and fissures.

Sapwood soft, porous, heartwood reddish-brown, compact, hard and heavy; used for building and ploughs, as fuel, and to make charcoal. The bark is used for tanning, and the leaves are lopped for cattle-fodder. The acorns are greedily eaten by pigeons, bears, and the large (Langūr) monkey. They form part of the officinal *Balūt* of the Panjab bazaars, given as a diuretic and in gonorrhœa.

5. **Q. dilatata**, Lindley; Royle Ill. t. 84, f. 2.—Syn. *Q. floribunda*, Lindl. Vern. *Zāih*, Kafiristan; *Bān, banji, banchar, barachar, barāin, banni, parūngi, chora, kāli ring, māru, māur, moru, karsh, marghang*, Pb.; *Moru, tilanga, kilonj, tilonj, timsha*, N.W.P.

A large evergreen tree, glabrous, youngest shoots only with slight floccose pubescence. Leaves glabrous, dark-green, coriaceous, shining, oblong-lanceolate with a rounded or cordate base, entire or with sharp spinescent teeth; blade 2-3 in., petiole ¼ in. long; main lateral nerves 8-12 pair, joined by minute reticulate veins. Male fl. in slender, lax, drooping catkins; female fl. in short axillary spikes. Styles 3-5 linear-clavate. Acorns generally solitary, short-pedunculate or subsessile, ovoid, brown, half exserted, the lower half enclosed in a hemispherical cup; scales lanceolate, closely adpressed, the ripe acorns on the branch of the current year.

North-east Afghanistan, Bharaul in Kafiristan (6000-7000 ft.) Safedkoh (9000-10,000 ft.) Eastern flanks of the Suliman range (6000-7000 ft.) Common on the outer ranges of north-west Himalaya from 4500 to 9000 ft., extending east to the Kali. In the Sutlej valley Jani in Kunawar is the upper limit of this species. Flowers and changes its leaves in spring. Gregarious, but generally associated with other trees. Attains 80-90 ft., with a fine close dark-green crown, and a tall, erect, but often gnarled trunk, 8-9 ft., at times 15 or 18 ft. in girth. Madden notes a tree 100 ft. high and 19 ft. 8 in. girth. Bark brownish-grey, with elongated scales, darker and larger than those of *Q. semecarpifolia.* Wood brownish, hard heavy and durable, largely used in building, for agricultural implements, axe-handles, and for Jampan-poles. On the Sutlej the timber of this species is prized more than that of the other Oaks, the order of merit of the others being *Q. incana, semecarpifolia* and *annulata.* The leaves are prized as fodder for sheep and goats, and the trees are often severely lopped for that purpose.

6. *Q. pedunculata,* Ehrh. *British Oak. Chêne pédonculé,* French; *Stieleiche,* German. A large long-lived timber-tree. Leaf-buds ovoid; leaves deciduous, short-petiolate or subsessile, obovate-oblong, with auriculate base, generally deeply cut into broad rounded lobes, glabrous or slightly hairy beneath along midrib; main lateral nerves 6-12 pair, often alternating with shorter intermediate ones. Perianth-segments of male flower lanceolate; anthers glabrous; styles broad and short. Fruit 1-5 on axillary peduncles 2-6 in. long on the current year's wood. Scales of cup adpressed. Europe, Asia Minor, Ural and Caucasus, forming extensive and often nearly pure forests in the alluvial plains along the principal rivers of Central Europe—*e.g.*, in Hungary, Croatia, on the Oder and Elbe in North Germany, on the Loire and the Adour in France.

7. *Q. sessiliflora,* Sm. *Chêne rouvre,* French; *Traubeneiche,* German. Like the former, but leaf-buds ovoid-lanceolate, leaves obovate-oblong, narrowed into a petiole ½ in. long, deeply cut into oblong or broad rounded lobes, pubescent when young, glabrate or pubescent when full-grown; main lateral nerves 6-10 pair, often alternating with shorter intermediate ones. Fruit in sessile or subsessile clusters. Leaves and flowers generally 10-14 days later than of *Q. pedunculata.* Europe and Asia Minor, forming extensive forests, often associated with the Beech and Hornbeam, rarely pure, on mountainous and hilly ground, not, as a rule, on alluvial soil. *Q. pubescens,* Willd., is a tomentose variety principally found on warm dry hills in South Europe, where it takes the place of the more glabrous *Q. sessiliflora* of the North.

In England and the lowlands of Scotland *Q. pedunculata* is the commoner of the two Oaks, but in North Wales and the hill-parts of northern England *Q. sessiliflora* is more frequent (Benth. British Fl. 422). Intermediate forms between these two Oaks are found in England and elsewhere, and the leading systematic botanists of the present day, Bentham, Hooker, and A. De Candolle, unite them under the name of *Q. Robur*, Linn. Foresters, however, particularly in France and Germany, find no difficulty in keeping them apart. The seedlings of both species have a long tap-root; they coppice vigorously, and the bark is used largely by tanners. The value and uses of Oak-timber for casks and barrel-staves, furniture, house- and ship-building, are well known. There is not much difference in the structure and qualities of the timber of the two species. Sapwood small, soft, whitish, decays rapidly, and is attacked by insects; the heartwood well defined, brown, hard, strong and generally durable, except under certain circumstances in contact with iron. Medullary rays of two classes; numerous very fine rays and (comparatively) few very large rays, some commencing at the centre, others at the outside of annual rings; the large rays ⅛-¼ line wide, 2-3 in. high, giving the wainscot appearance on vertical sections. Annual rings distinctly marked by an inner belt (spring wood) of large pores, close together, and an outer belt of compact wood with fine pores, generally arranged in linear or wedge-shaped patches at right angles to the annual rings, and only visible under the glass. The weight of Oak (seasoned heartwood) fluctuates between 33 and 64 lb. per cubic ft. It is an interesting question, which is not without practical importance, how far the weight of Oak-timber depends upon the width of the annual rings. Mathieu (Fl. For. 234, 240) is of opinion that faster-grown Oak-timber is generally heavier, the porous tissue of the spring wood forming a smaller proportion of the entire wood. The following data, which I have noted on samples of Oak-timber from different sources presented to the Kew Museum by the Admiralty, bear out this view to a certain extent; slow-grown Adriatic timber, for instance, with 20 rings on one inch of radius, weighing 41 lb. per cub. ft., while faster-grown wood from Trieste, with only 6⅜ rings, weighs 50 lb. Exceptions, however, are not wanting; thus the heaviest timber is a somewhat slower-grown wood from Sardinia with 11 rings per inch :—

Sardinia,	66	rings on 6 in. of rad.	Weight,	59.3	lb.
Trieste,	40	„ „	„	50.6	„
Dantsic,	75	„ „	„	48.4	„
Italy,	72	„ „	„	48.1	„
Tuscany,	84	„ „	„	46.2	„
Adriatic,	120	„ „	„	40.9	„

8. *Q. Toza*, Bosc; Kotschy l. c. t. 22. *Chêne tauzin*, Fr. A small deciduous tree, young shoots silvery white; with long spreading roots, throwing up abundant root-shoots. Leaves petiolate, obovate-oblong, generally pinnatifid, segments linear-oblong, the middle ones often lobed, thick-velvety beneath, and pubescent above with stellate hairs. Perianth-segments of male fl. lanceolate, hairy; anthers glabrous; styles broad and short. Fruit 2-4, short-pedunculate, on the current year's wood; scales of cup adpressed. West of France, Spain, Portugal, probably also in Syria. Forms vigorous coppice-woods on sandy soil, and yields excellent bark for tanning. Wood mainly used for fuel.

9. *Q. lusitanica*, Webb; DC. Prodr. xvi. ii. 17. A large tree, sometimes a shrub, the foliage deciduous in autumn or persistent to the end of winter. Leaves ovate- or obovate-oblong, generally grey-tomentose beneath while young, glabrate when full-grown, dentate with large triangular rounded or oblong teeth; main lateral nerves straight, parallel, undivided, 10-14 pair. Perianth-segments of male fl. lanceolate; anthers glabrous; styles thick, short. Fruit on the current year's wood, sessile or short-pedunculate, solitary or in pairs; scales of cup adpressed. Mediterranean region, Syria and Asia Minor. To this sp. belong, according to A. De Candolle, *a.* the "*Chêne zeen*" of Algeria, *Q. Mirbeckii*, Durieux, Mathieu Fl. For. 250, a magnificent long-lived tree, attaining 120 ft., with 20 ft. girth, and forming extensive forests, particularly in Eastern Algeria.

β. *Q. infectoria*, Olivier, the *Gall* or *Dyers' Oak*. A shrub or middle-sized tree in Greece, Bosnia, Asia Minor, and Syria, extending east to the confines of Persia, with cylindrical acorns, the leaves grey underneath, yielding the Galls used in medicine and dyeing, which are imported into Europe from the Levant.

10. *Q. Cerris*, Linn.; Reich. Ic. Fl. Germ. t. 650.—Syn. *Q. austriaca*, Willd.; Kotschy Eichen, t. 20. *Turkey* or *Mossy-cupped Oak*. *Chêne chevelu*, Fr.; *Zerreiche*, Germ. A large tree. Leaves petiolate, elliptic or oblong, variously lobed, often pinnatifid, pubescent and pale beneath, glabrous above, main lateral nerves 6-10 pair; stipules and outer bud-scales long, setaceous. Perianth-segments of male fl. 4-6, oblong or ovate; stamens 4-6, anthers hairy; styles linear, recurved. Fruit on the previous year's wood, solitary, or in clusters of 2-4, sessile or on short thick peduncles; cup large, scales free, subulate, spreading or recurved. Asia Minor, North Syria, South Europe, extending north to Hungary and Lower Austria, and in France to the Doubs and Loire. Often associated with the common Oak. Fl. May; the fruit ripens in Sept. of the second year; the leaves fall in Oct. or Nov. The *Lucombe* and *Fulham* Oaks, believed to be hybrids between *Cerris* and *Suber*, are evergreen, or nearly so. Structure of the wood similar to that of the common Oak; the sapwood is larger, the heartwood of a deeper brown, and the large rays more numerous, giving it a most varied and beautiful wainscot grain. Weight, 53-58 lb. It grows more rapidly than the common Oak, with a straight powerful terminal shoot; in England it was introduced in 1735, and trees 10-12 ft. girth are not rare.

Q. pseudosuber, Santi; Kotschy l. c. t. xxxv., differs from *Q. Cerris* by persistent, coriaceous, less deeply lobed leaves which are grey-tomentose beneath. In a few localities of Provence, in Algeria, Sicily, Italy, and Istria. Yields cork of an inferior description.

11. *Q. Ægilops*, Linn.; Hook. Trans. Linn. Soc. xxiii. 384, t. 38.—Syn. *Q. Vallonea*, Kotschy l. c. t. 7. *Vallonea Oak*. A moderate-sized tree, leaf-buds obtuse, hoary, branchlets of the current and previous year grey-tomentose. Leaves ovate or ovate-oblong, grey-tomentose beneath, and often on the upper side also, dentate with large triangular cuspidate teeth or deeply lobed and often pinnatifid, main lateral nerves 6-10 pair, midrib flexuose in the upper part of leaf. Male fl. mostly hexandrous, bracteoles lanceolate, caducous, generally longer than perianth, anthers hairy, not apiculate. Styles subulate, recurved. Fruit sessile, solitary, cup large, 1-1½ in. diam., at first enclosing the acorn, afterwards hemispherical, scales free, thick, linear, often angular, hoary, erect or more generally reflexed, acorn ovoid, more commonly cylindrical, 1-2 in. long, green when ripe. Eastern Mediterranean, Asia Minor, Syria. In Syria the tree grows gregariously, never as a bush, but rising on a stout gnarled trunk 3-7 ft. in girth, to the height of 20-30 ft., Hook. l. c. 385. The acorns are eaten raw and boiled, the cupule is used for tanning and dyeing, and is exported in large quantities from Asia Minor under the name of *Vellani*, *Vallonea*. The leaves fall in winter or early spring, a little before or after the young leaves come out.

Q. persica, Jaub. et Spach; DC. Prodr. xvi. ii. 47, of Persia and Kurdistan, differs by oblong or ovate-lanceolate leaves, with 10-16 pairs of main lateral nerves.

12. *Q. Suber*, Linn.—*Cork Oak*. *Chêne liège*, Fr. *Sovero*, *sughero*, It. A middle-sized, long-lived tree, with thick corky bark, and scanty foliage, otherwise resembling *Q. Ilex*. Leaves evergreen, remaining two years on the branches and sometimes longer, branchlets and under side of leaves with short grey tomentum. Leaves ovate or ovate-oblong, acute, crenate or dentate, the teeth sometimes long-cuspidate; blade about 2, petiole ¼ in. long. Male fl. in fasciculate, somewhat compact, drooping catkins, perianth campanulate, 6-fid, anthers generally hairy. Styles linear, recurved. Fruit solitary or in pairs, on

short thick peduncles, on the current year's wood. Lower scales of cup ovate, adpressed, upper lanceolate, spreading. Western Mediterranean region, Southern and Eastern Spain, Algeria, South France, Corsica, Italy, Sicily, Dalmatia. Attains a very large size in Andalusia. Hardy in England. The wood is similar to that of *Q. Ilex,* medullary rays very broad, nearly 1 line wide, but larger pores. Cork is the outer bark of the trunk, composed of cellular tissue ; it commences to form at an early age, and is generally taken off in intervals of 7-10 years. It is removed during the summer months, and great care is necessary not to injure the surface of the inner bark, and the layer of soft cellular tissue between the inner bark and the cork, from which the latter is regenerated. The naked trunks of the trees from which the cork has recently been removed, have a peculiar reddish colour, until they reclothe themselves with a fresh layer of cork. The first crop (called *liège mâle* in Provence) is cracked and irregular, and is generally without value; the succeeding crops form the cork of commerce, and a tree continues to yield these periodical crops until an advanced age. The principal supply of cork comes from Spain, but France also has fine and valuable Cork-Oak forests ; the tree is often mixed with *Q. Ilex* and *Pinus Pinaster,* on the range of hills called Les Maures in Provence, between Hyères and Draguignan, and in Corsica. In Algeria the Cork-Oak forests are more extensive, but they have of late years suffered much from fires. The tree has a thin and light foliage, and thus favours the growth of *Erica arborea* and other underwood, which catches and spreads fire readily during the dry and hot summer months. In Provence, also, destructive forest-fires have at various times damaged extensive forests containing the Cork-Oak. Plants of the Cork-Oak have repeatedly been sent to India, but as yet without much success.

13. *Q. 'occidentalis,* Gay ; DC. Prodr. xvi. ii. 44 (figd. by Kotschy l. c. t. 33 as *Q. Suber*), differs from *Q. Suber,* mainly by requiring two years to ripen its fruit, which is on short stout peduncles on the previous year's wood. Portugal, Gallicia, Asturia, South-West France. The leaves remain a little more than a year on the branches. Produces cork of excellent quality, which is collected like that of *Q. Suber*. More hardy than *Q. Suber,* extends considerably farther north; many of the old Cork-Oak trees in England and Ireland belong to this species. Mathieu (Fl. For. 265) relates a remarkable instance of Cork-Oak plantations made at Belle-Isle-en Mer (lat. 47° 20'), in 1826, with plants and acorns brought from Catalonia (*Q. Suber*) and the Landes (*Q. occidentalis*). The former all perished, but the latter survived. In spite of these interesting and well-established facts, it seems doubtful whether *Q. occidentalis* ought to be retained as a distinct species. The duration of the leaves, and the time which the acorns require to ripen, are subject to great variations in several species of this genus ; and it seems doubtful whether these characters can, in the present case, be relied upon for specific distinction.

14. **Q. serrata,** Thunb. Fl. Jap. 176 (not of Roxb.)—Syn. *Q. polyantha,* Lindl. in Wall. Cat. 2771.

A middle-sized deciduous tree; buds ovoid-lanceolate, closed, scales acute, floccose, youngest shoots pubescent with soft hairs, flowers tawny-tomentose. Leaves oblong-lanceolate when mature, coriaceous, glabrous, shining, often with tufts of hairs in the axils of the main lateral nerves, young leaves soft-tawny-tomentose beneath, and with scattered hairs on the upper side ; main lateral nerves 14-16 pair, parallel, each terminating in a long fine subulate serrature, often ¼ in. long, transverse nerves numerous, fine, at right angles to lateral nerves ; blade 4-6, petiole slender, 1-1½ in. long.

Male flowers in slender pendulous racemes, bracteoles ovate-lanceolate, a little longer than perianth. Female flowers in short axillary spikes, style filiform, with capitate and often bifid apex. Fruit subsessile on the previous year's wood, solitary or in clusters of 2-3, cupule at first enclosing the acorn, opening afterwards, scales numerous, free, linear or subulate, hoary, the outer reflexed, the inner erect; acorn subglobose, glabrous, shining, more than half immersed in the cup, which is 1½ in. diam.

Nepal, Sikkim (3000-5000 ft.), Kasia. Japan, Korea, North and West China. Fl. March-May. The young leaves appear with or after the flowers (in Japan, in May). The wood has middle-sized pores and broad medullary rays. This is one of the species of Oak on which the Japanese Oak-silkworm (*Yamamāi* or *Yama mayu,* Mountain Cocoon) lives, which yields a strong but rough and hard silk, spun in Japan with cotton or other silk, but not much exported. The tree is either planted in avenues or as short rotation coppice-wood, which is cut over every third or fifth year. The eggs (glued on strips of paper) are tied to the Oak-bushes when the buds begin to swell; sometimes they are bred under cover on Oak-bushes placed in water, and put out upon the trees when they are a few weeks old. This silkworm is also raised on the hills of the Shantung and Sechuen districts in China (Ostr. Ungar. Expedition nach Siam China u. Japan, 1872, Append. 172, 282).

Q. serrata, Roxb. Fl. Ind. iii. 641; Ill. in Herb. Kew, 2393, has male and female flowers, with much soft dark-brown down (Roxb.), in long erect paniculate spikes, and probably is *Castanopsis indica,* A. DC.

15. *Q. coccifera,* Linn.; Sibthorp. Fl. Græca, t. 944; Reichenb. Fl. Germ. t. 643; Kotschy l. c. t. 29.—*Chêne kermès,* Fr. A shrub, sometimes a small tree, branchlets and young leaves with scattered stellate hairs. Leaves ovate or oblong-ovate, dentate with spinescent teeth, small, firm, coriaceous, glabrous, shining, dark green, with prominent reticulate veins and indistinct lateral nerves. Male flowers distant, in lax pendulous catkins, perianth 2-6-fid; stamens 2-6, anthers glabrous, apiculate; styles subulate, recurved. Fruit solitary, sessile on the previous year's wood, scales of cup connate at the base, upper part free, linear, reflexed, the innermost scales erect. Forms large extent of low brushwood on dry hills in the Mediterranean region, used as fuel, the bark for tanning; a Coccus which lives on this species was formerly collected and used largely as a dye.

Q. calliprinos, Webb; DC. Prodr. xvi. ii. 54—Syn. *Q. pseudococcifera,* Hook. Trans. Linn. Soc. xxxiii. 381, not Desf.; *Chêne garrigue,* Fr.—is supposed to differ from *Q. coccifera,* by oblong leaves with cordate base, the teeth rarely spinescent, and a larger cup with longer but not spinescent scales; but these characters are not constant, and there are intermediate forms, so that possibly they may eventually be regarded as one species only. Mediterranean region and Western Asia to the borders of Mesopotamia. Often a low shrub only, but where protected grows into a stately tree. The famous Oak of Mamre, called "Abraham's Oak," belongs to this species; Hooker (l. c. t. 36) gives a sketch of it, and states that this species is by far the most abundant tree throughout Syria, covering the rocky hills, of Palestine especially, with a dense brushwood of trees 8-12 ft. high, branching from the base, thickly covered with small evergreen rigid leaves and bearing acorns copiously, which like the cup are exceedingly variable in shape.

16. **Q. annulata,** Smith.—**Tab. LXV.**—DC. Prodr. xvi. ii. 100.—Vern. *Brān, bren, banni, indri,* Pb.; *Pharonj, phanāt, phaliant,* Kamaon.

A large or middle-sized evergreen tree, nearly glabrous, buds glabrous, shining, ovoid, often more or less distinctly 4-sided, the scales imbricate all round or arranged in four vertical rows. Leaves coriaceous, glabrous and shining above, clothed beneath while young with grey short silky pubescence, lanceolate-oblong with an unequal-sided base, acuminate, lower half entire, upper half with sharp cuspidate and somewhat curved serratures, main lateral nerves undivided, 10-14 pair; blade 3-6, petiole ½-1 in. long. Male flowers in lax slender drooping catkins, bracteoles lanceolate, twice the length of perianth, hairy, perianth of 5 lanceolate segments. Female flowers sessile, 2-3 on short axillary peduncles, scales of cupule more or less connate into 2-3 concentric sheaths, the outer often 5-lobed, styles 4, broad and short, recurved. Fruit solitary or in pairs, on short stout peduncles, cup hemispherical, consisting of 4-8 concentric grey velvety belts, the inner entire, the outer obtusely dentate, acorn short ovoid, glabrous, shining, the lower half enclosed in the cup.

Q. semiserrata, Roxb. Fl. Ind. iii. 641; Wight Ic. t. 211, from Silhet, is probably this species; the description and the drawing (Ill. in Hb. Kew, 2392) agree, with one exception; the gland is cylindric and four times longer than the cup. Nothing is known regarding the male flower, and I have not seen authentic specimens. It is a common tree in Burma, where it is called *Thitcha*. *Q. velutina*, Lindl., is probably the same species.

Valleys of the outer Himalaya, ascending to 5000 ft., here and there on the Jhelam, Chenab, Ravi, Bias, and Sutlej, more common in Garhwal and Kamaon, Nepal, Sikkim, Bhutan, Kasia hills. Generally on warm dry slopes, often gregarious and associated with *Q. incana* near the lower limit of that tree. These two species form coppice-woods in the Kangra valley with standards of *Albizzia stipulata* (*Oi*). Fl. March, June; the fruit ripens Aug. to Oct. Attains 60 ft. with a straight erect trunk 5-6 ft. girth. Growth slow. Bark dark grey, rough with transverse deep and short thick-edged fissures. Wood similar to that of *Q. incana*, but less valued.

17. **Q. lamellosa**, Smith; Wall. Pl. As. rar. t. 149; Hook. f. Ill. Him. t. 20.—Vern. *Shalshi*, *pharat-singhali*, Nepal.

A large tree, with thick branchlets, and short subglobose leaf-buds, the scales spirally arranged. Leaves firm, coriaceous, white, waxy beneath, and with matted deciduous pubescence, oblong-lanceolate or elliptic, cuspidate-serrate, main lateral nerves 20-25 pair, like the midrib impressed on the upper side and very prominent beneath, joined by transverse veins at right angles, blade 6-12 in., petiole 1½ in. long. Fruit in short pedunculate axillary spikes, cup while young of few, when full-grown of numerous (10-16) concentric belts, hemispherical, attaining 2 in. diam., acorn velvety, subglobose, more than half enclosed in the cup. *Q. paucilamellosa*, Alph. DC. Prodr. xvi. ii. 101, is not specifically distinct, the number of concentric belts is larger in full-grown cups.

Nepal, Sikkim (5000-8000 ft.) One of the commonest trees about Darjiling. Bhutan. Fl. in spring; the fruit ripens in November. Attains 80-120 ft., with a tall straight trunk 40-60 ft. high, and 9-15 ft. girth.

18. **Q. spicata,** Smith; Wall. Pl. As. rar. t. 46.—Syn. *Q. squamata,* Roxb. Fl. Ind. iii. 638; Wight Ic. t. 213. Vern. *Dandwa singali, phaco singhali, arkaula,* Nepal; *Bara chakma,* Silhet; *Thitcha,** Burm.

A large evergreen tree, with thick, glabrous branchlets. Leaf-buds open, scales imbricate, lanceolate, cuspidate. Leaves entire, glabrous, shining, coriaceous, thick and firm, elliptic-lanceolate or oblanceolate, narrowed into a short petiole, 6-9 in. long, main lateral nerves 12-18 pair. Flowers in erect terminal and axillary spikes, forming terminal panicles. Male and female flowers on distinct spikes, and often on separate trees. Male flowers in sessile globose or elongated tomentose heads, supported by 3 lanceolate bracts, the middle one longer than the lowest flower, with subulate bracteoles between the flowers. Perianth-segments 5-6, stamens 10-12, surrounding a tomentose rudimentary ovary. Fruit in sessile clusters of 3-5, arranged in erect spikes with woody rachis, 9-12 in. long. Cup with adpressed imbricate scales, enclosing the acorn while young, afterwards flat-concave, supporting the base of the subglobose acorn, adjoining cups generally connate. Acorn hard, ⅝-1 in. diam.

Nepal, Sikkim (2000-4000 ft.), Bhutan, Assam, Kasia, Chittagong, Burma, Indian Archipelago. Fl. March, April; the fruit ripens Sept.-Oct. of the second year.

Other common Indian evergreen Oaks of this section with entire leaves and spicate fruit, are: 1. *Q. fenestrata,* Roxb., glabrous; scales of cup imbricate, nearly connate, apex free, spreading. East Bengal, Burma. Wood hard, warps much, medullary rays very broad. 2. *Q. dealbata,* Hook. f. & Th. (probably identical with *Q. acuminata,* Roxb.), leaves white-hoary beneath, scales of cup imbricate. East Bengal, Burma. 3. *Q. lappacea,* Roxb., with pubescent membranous or thinly coriaceous leaves, upper half of cup-scales free, spreading. East Bengal, Burma. 4. *Q. lanceæfolia,* Roxb., glabrous; cup with concentric bands, without scales, enclosing ⅓ of acorn. A species differing from most other Oaks by a ruminate albumen, and by the structure of the wood, which has very fine medullary rays. East Bengal, Burma.

2. **CASTANOPSIS,** Spach.

Evergreen trees with entire, rarely serrate coriaceous penniveined leaves. Flowers in erect spikes, arranged in terminal panicles, the female flower-spikes generally terminal, the male spikes lateral and more numerous. Male flowers fasciculate; perianth 5-6-lobed; stamens generally twice as many, surrounding a hairy rudimentary ovary; anthers small, 2-celled, cells connate. Female flowers 1-3, included in an involucre of numerous scales. Limb of perianth of 6 biseriate segments. Ovary 3-celled, with 2 ovules in each cell; styles 3, rarely more, linear, stigmatose at the apex. One to three 1-seeded nuts entirely included in the enlarged capsuliform subglobose involucre, which is coriaceous, outside thickly covered with sharp, often branching, prickles, and splits open irregularly. Cotyledons farinaceous.

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* *Thitcha* is the Burmese name also for *Q. fenestrata, lappacea, semiserrata,* and other Oaks.

Leaves entire, glabrous; involucre tomentose, with stout stellate and branching spines . . . . 1. *C. tribuloides.*
Leaves serrate, tomentose beneath . . . . 2. *C. indica.*

1. **C. tribuloides**, Alph. DC.; Prodr. xvi. ii. 111.—Syn. *Quercus armata*, Roxb. Cor. Pl. t. 296; Fl. Ind. iii. 640; Wight Ic. t. 770. *Q. ferox*, Roxb. l. c. 639; Wight Ic. t. 218. Vern. *Tūmari*, *katonj*, Kamaon; *Kanta singar*, Assam; *Singhara*, Tipperah; *Kyantsa*, Burm.

A large evergreen tree, youngest shoots slightly pubescent, leaf-buds open, with erect lanceolate scales. Leaves entire, firm-coriaceous, glabrous, shining, pale beneath, lanceolate, 3-6 in. long, narrowed into short petiole, main lateral nerves 8-12 pair. Flowers in erect paniculate pubescent spikes, male and female flowers on distinct spikes, but generally in the same panicle. Male flowers sessile, solitary, or 3-5 together, in small clusters; perianth of 6 segments; stamens 12, on long filaments, surrounding a tomentose rudimentary ovary. Styles long, linear, erect. Fruit on long erect spikes, with woody rachis; acorn ovoid, completely enclosed by the thorny involucre, which is grey-tomentose, and thickly set with stout stellate and branching spines, each about ½ in. long. Cotyledons ruminated.

South-east Kamaon, near the right bank of the Sarda river, between 2000 and 6000 ft. Nepal, Sikkim (4000-7000 ft.), Bhutan, Kasia, Chittagong, hills in Burma above 3000 ft. Fl. April, May; the fruit ripens in autumn of the second year. Wood hard, weight 62 lb.; in Nepal large mortars and pestles for grinding grain are made of it, and it is a favourite wood for carpenters' work.

2. **C. indica**, Alph. DC.; Prodr. xvi. ii. 109.—Syn. *Castanea indica*, Roxb. l. c. 643.

A middle-sized evergreen tree, current year's branchlets and under side of leaves rusty-tomentose, leaf-buds open, scales lanceolate. Leaves subsessile or short-petiolate, elliptic or elliptic-lanceolate, cuspidate-serrate, 6-9 in. long, main lateral nerves 15-20 pair. Flowers in erect paniculate tomentose spikes, male and female flowers generally in distinct spikes, but in the same panicle. Male flowers sessile, in rounded bracteate clusters; perianth of 6 segments; stamens 12, filaments long slender, surrounding a tomentose rudimentary ovary. Female flowers solitary, or 2-3 in one cup, often with short stamens; styles linear, erect, the ends spreading. Fruit in erect spikes, with a thick woody rachis. Acorns often 2 in one cup, which encloses them completely, and is thickly set with fasciculate prickles about ½ in. long. Cotyledons not ruminated.

Nepal, ascending to 4000 ft. Sikkim, Terai, Assam, Kasia, Chittagong. Fl. Aug.-Nov.; the fruit ripens in the following autumn. The seeds are eaten in Silhet, and are said to taste like inferior filberts.

Two genera, *Fagus* and *Castanea*, important as forest-trees in Europe, are allied to the Indian *Castanopsis*. In both, the involucre encloses several female flowers with linear styles, and is enlarged and hardened during maturity into a coriaceous capsule-like covering, which splits into 4 valves, covered, in the case of *Fagus*, with soft bristles, enclosing a three-cornered nut, and in the case of *Castanea* with numerous sharp stellate prickles, enclosing a rounded nut. The male flowers of *Fagus* are in pendulous heads, those of *Castanea* in long slender erect spikes, having at their base a few involucres with female flowers. The cotyledons of *Fagus* are oily, raised aboveground, and become green when germinating. Those of *Castanea* are farinaceous, and remain underground.

Fagus sylvatica, Linn.; Hook. Stud. Fl. 344, the *Beech—Buche*, Germ.; *Hêtre*, Fr. A large, not very long-lived, deciduous tree, with dense shady foliage, under which no grass, and very few shade-enduring shrubs, such as the Holly, will grow, but which enriches the soil. The tree bears a large amount of shade overhead, and forms a most useful mixture with Oak and Scotch Fir, the Beech being cut at 80-100 years, and the Oak and Fir being left to attain twice that age. The wood is white when fresh cut, turning into a reddish-grey when dry; it has no distinct heartwood. The pores are fine, numerous, uniformly distributed; the medullary rays numerous, not long, often interrupted, of two classes, narrow and broad, appearing on a vertical section as shining plates. An excellent fuel, but not durable, and apt to warp and split. Weight, 41-52 lb. The wood is used for tools, furniture, wooden shoes, the keels of vessels; and in France, North Italy, and Austria, after impregnation with sulphate of copper, for railway-sleepers. The wood of clean stems which have grown up in compact masses splits well, and is made (in North Italy, Cansiglio forest near Treviso) into sieve-frames and similar articles. The Beech does not attain the same age as the Oak, but it generally grows more rapidly. The tallest tree I have seen is a renowned beech in the Steigerwald, near Kloster Ebrach, Franconia; 150 ft. high, stem 90 ft. to the first branch, 15 ft. girth at foot, and 9 ft. at the first branch, supposed to be 300 years old. Beeches exceeding 20 ft. girth are not uncommon in England. Its home is Western, Central, and South Europe, not in Greece, and it is common on the Taurus and Caucasus (Talish and Elburg). Its north limit passes through the south of Norway and Sweden; it is not found indigenous in Russia north of the 52d degree north latitude. In South Europe the Beech is only found at a considerable elevation, and sometimes forms the upper limit of forest vegetation. On the mountains of Corsica, for instance, the vertical regions are as follows: 1°. Evergreen brushwood (Maki); 2°. *Pinus Pinaster*, *Quercus Ilex*, and *Castanea vesca*; 3°. *Pinus Laricio*; 4°. *Abies pectinata* (the Silver Fir); and 5°. the *Beech*. The tree has a marked partiality for limestone and chalk; well-known instances are the fine beech-forests of Buckinghamshire, the luxuriant growth of the tree on the chalk cliffs of Moen and Rügen, and the magnificent forests on Muschelkalk and Lias in Central Germany.

Castanea vulgaris, Lam.; DC. Prodr. xvi. ii. 114.—Syn. *C. vesca*, Gærtn. *Sweet Chestnut—Châtaignier*, Fr.; *Edelkastanie*, Germ. A large, long-lived, deciduous tree, of rapid growth while young, more rapid than the oak, and attaining a gigantic size, stems 30-40 ft. girth and certainly 1000 years old not rare in South Europe, and much larger stems being on record—*e.g.*, the renowned chestnuts of the Ætna, two trees, sound and vigorous, 60-80 ft., and one (castagno dei centi cavalli) hollow, in 5 pieces, more than 190 ft. girth. Sapwood white, heartwood dark-brown, the annual rings distinctly marked by a belt of large pores close together (spring wood), surrounded by an outer belt of more compact wood with very fine pores, generally arranged in wavy lines. Medullary rays very fine, numerous, which distinguishes chestnut from oak timber at a glance. Weight, 37-54 lb. Old trees have often ring-shakes and central hollows, and the timber is not so durable as that of oak; in the south of Europe it is used for building, furniture, and cask-staves; but the legends of the roofs of old churches and other buildings made of chestnut timber, in France and England, are mythical—wherever examined, such timber has been found to be oak. It coppices vigorously; along the Vosges it is grown for vineyard poles, in Kent and Sussex for hop-poles. In the south of Europe the chestnut forms extensive forests more or less cultivated, the fruit being its most valuable produce, forming an important article of food for the inhabitants of the mountainous regions of Central France, Spain, Corsica, Italy, and Greece. It is not certain whether its original home is in Asia Minor and Greece, or whether it is also indigenous in Italy and Spain. In England it was introduced at an early age. The tree has been grown in the N.W. Himalaya, and should be encouraged as an important food-producing tree, wherever it bears fruit.

3. **CARPINUS,** Tournef.

Deciduous trees; buds elongate, closed, with imbricate scales. Leaves membranous, serrate. Male flowers in drooping sessile lateral hairy catkins; perianth none; stamens 6-12 on short filaments, attached to the base of the broad-ovate scales; anther-cells distinct, stipitate, hairy at the tip. Female flowers in slender drooping terminal spikes, in pairs in the axils of deciduous linear-lanceolate bracts, each flower supported by a 3-lobed or undivided persistent involucre, which is enlarged in fruit. Ovary 2-celled, limb of perianth dentate; styles 2, erect, filiform. Fruit 1-seeded, enclosed in a hard pericarp, 6-12-ribbed, crowned by the perianth-teeth, and often by the persistent styles, small, many times shorter than the enlarged membranous 3-7-nerved reticulate involucral bracts.

Leaves ovate-lanceolate, long-acuminate, duplicate-serrate . .	1. *C. viminea.*
Leaves ovate-oblong, acute, serrate, teeth simple, subulate . .	2. *C. faginea.*

1. **C. viminea,** Wall., Pl. As. Rar. t. 106; DC. Prodr. xvi. ii. 127. Vern. *Charkhri, kāi*, Pb.; *Pumne, goria, chamkharak*, N.W.P.

A moderate-sized tree with slender drooping verrucose branches; leaf-buds cylindric, scales shining, fringed with short soft hairs. Leaves glabrous, ovate-lanceolate, with large serratures serrulate on the outside, long-acuminate, acumen linear, serrate; blade 3-4 in., petiole slender, hairy, ½ in. long. Involucral bracts ¾ in. long, 3-5-nerved, lanceolate, unequal-sided, the broad half dentate with large obtuse teeth, the narrow half entire, often with a short lobe near the base; fruit 1-2 lines long (2-seeded, Lindley in Wall. l. c.)

Himalaya, extending west to the Ravi, between 5000 and 7000 ft. Kasia hills. Male catkins appear before the leaves, female fl. with the leaves in spring. Fr. June-Sept. Often found near water. Bark thin, grey. Wood yellowish-white, hard, heavy, believed to be durable. Growth moderately slow, 10 rings per inch.

2. **C. faginea,** Lindley.—**Tab. LXVI.**—Wall. Pl. As. Rar. ii. 5. Vern. *Shirāsh, īmar*, Pb.; *Gīsh*, N.W.P.

A moderate-sized tree; branchlets and petioles soft-tomentose. Leaves pubescent when young, glabrous afterwards, elliptic-oblong, acute, short-petiolate, serrate with simple subulate serratures, 3-5 in. long. Involucral bracts ⅔ in. long, pubescent, 4-6-nerved, triangular, very unequal-sided, the midrib close to one side, which is entire, forming the basis of the triangle, the other two sides coarsely dentate.

On the Bias between 4000 and 5500 ft., on the Sutlej at 6000, in Garhwal, Kamaon at 7000 ft. Nepal and Bhutan. Bark dark brown, smooth, lightly wrinkled. Fl. March, April; fr. July, Aug.

Two species of *Carpinus* are in Europe. 1°. *C. Betulus*, L.; Hook. Stud. Fl. 345, the *Hornbeam—Charme*, Fr.; *Hainbuche*, German, with duplicate-serrate leaves, 3-lobed involucral bracts, the middle lobe longer; a moderate-sized slow-growing tree, with great powers of reproduction. Coppices vigorously, and makes useful pollards on dry grass-land. Is not injured by frost, and is often seen in Germany fringing the edges of the Beech-forest along the bottom of valleys, where the Beech would suffer. The wood is white, heavy (39-51 lb., Nördlinger), and is marked by numerous medullary rays, which on a vertical section are 3-4 in. high. Great heating power, yields a better fuel than even the Beech. Used mainly as fuel; tool-handles, the teeth of cog-wheels, and screws of wood are made of it. Central and Eastern Europe, very common in Northern and Eastern France, indigenous in the South of England, and of Sweden. Western Asia as far east as Asterabad, south of the Caspian. In Central Europe commonly associated with the Beech.

2°. *C. duinensis*, Scop.—Syn. *C. orientalis*, Lam.; Reichenb. Ic. Fl. Germ. t. 634. A small tree or large shrub, with (generally) small duplicate-serrate leaves and ovate 6-8-nerved involucral bracts. Italy, Dalmatia, Hungary, Greece, Turkey, Asia Minor, Caucasus, Persia, and Turkestan.

Ostrya carpinifolia, Scop.—Syn. *O. vulgaris*, Willd.; Reichenb. Fl. Germ. t. 635—the *Hop Hornbeam*, is a moderate-sized tree, with leaves similar to those of the Hornbeam, from which it is distinguished by the involucral bracts, forming a membranous oval bag enclosing the fruit. Central and Eastern Mediterranean region, not in Spain, and in France only near Nice, and on the coast a little farther west. Forests of it in Greece. Asia Minor, Armenia.

4. CORYLUS, Tourn.

Deciduous shrubs or small trees; buds closed, scales imbricate; branchlets and petioles generally with glandular hairs. Male flowers in drooping cylindrical hairy catkins, catkins fasciculate, or 2-3 on a common peduncle, perianth none, stamens 4, attached to the inside of a broad scale, to the edges of which are attached two smaller scales; anther-cells distinct, with a tuft of hairs at the tip, on short, often partially connate filaments, appearing sometimes as 8 stamens with 1-celled anthers. Female flowers in small sessile ovoid lateral bud-like spikes, with imbricate scale-like bracts, the flowers in pairs in the axils of the upper bracts, each flower enclosed by two or more minute scales (involucre) cleft into numerous narrow lobes. Limb of perianth minutely toothed. Ovary 2-celled, 1 ovule in each cell; styles 2. Fruit usually clustered, each consisting of a hard usually 1-seeded nut, enclosed in the enlarged involucre (scales), which forms a leafy entire or 2-leaved sheath, mouth lobed, lobes sometimes spinescent. The oily cotyledons of the germinating seed remain underground.

Leaves ovate-oblong; lobes of involucre spinescent; stamens 4, anthers 2-celled, cells distinct, parallel	1. *C. ferox.*
Leaves obovate; lobes of involucre not spinescent; stamens 8, anthers 1-celled	2. *C. Colurna.*

1. **C. ferox**, Wall. Pl. As. Rar. t. 87; DC. Prodr. xvi. ii. 129.

A small tree, with elongate silky buds, the outer scales erect. Leaves pubescent when young, ovate-oblong, acuminate, closely serrate with unequal cuspidate serratures; blade 4-5 in., petiole hairy, ½ in. long. Catkins fasciculate, scales obovate, acute, bearing at their base 4 subsessile stamens, each with 2 distinct contiguous anther-cells. Fruit in clusters of 3-6, involucre villous, thick, almost fleshy, with pinnatifid lobes, the divisions terminating in slender spines ⅓ in. long. Pericarp hard thick.

Nepal, Sikkim (8000-10,000 ft.) Fl. Sept. Oct. Wood light, compact, and of a pale colour.

2. **C. Colurna**, Linn.—Syn. *C. Jacquemontii*, Dne. in Jacq. Voy. Bot. t. 160. *C. lacera*, Wall. Vern. *Urni*, Jhelam; *Winri*, *wūri*, *warawi*, *wūriya*, *thangi*, *thankoli*, Kashmir and Chamba; *Shūrli*, *sharoli*, *geh*, Sutlej; *Kapasi*, *bhotia*, *badām*, N.W.P.

A small or moderate-sized tree; buds short, nearly hemispherical. Leaves glabrous, obovate, acuminate, base cordate, unequally serrate, main lateral nerves 10-12 pair, each nerve terminating in a more or less distinct lobe; blade 5-6, petiole 1-1½ in. long. Catkins fasciculate, scales obovate, acute, bearing along the midrib eight 1-celled anthers on short often more or less connate filaments. Fruit in clusters of 2-3, involucre subcoriaceous, double, the inner sheathing, with numerous elevated ribs, cleft into linear-lanceolate serrate lobes with glandular hairs; the outer of several laciniate bracts.

N.W. Himalaya, 5500-10,000, ascending in places to 10,500 ft., on the Sutlej as far as Pangi on the right, and Poari on the left bank. Also in South-East Europe and Asia Minor. Gregarious, often forming extensive thickets, not rare near the upper limit of tree vegetation, and sometimes associated with *Parrotia*. Often cultivated. Hardy in England. Fl. early in spring; the fruit ripens in July, August. Generally a small tree with short trunk, but often (particularly cultivated specimens) attains 40-50 ft., with an erect somewhat gnarled trunk, 6-7 ft. girth. Growth apparently slow, 10-12 rings per inch of radius. Bark thin, brownish-grey, very rugose with numerous dark wrinkles, equal in width to the intervening low rounded ridges, the ridges divided by short cross-fissures into long scales, which in old trees often detach themselves at the base, and exfoliate upwards, like the bark of *Æsculus indica*. Wood compact, not hard or heavy, with fine medullary rays, considered a good timber—(have old trees a distinct, dark-brown heartwood?) The kernels are as good as English hazel-nuts, and form an important article of food in some parts of the hills. In the bazars of the Panjab plains they are sold under the name of *findak* for medicinal purposes. They are imported into England from the Levant as Turkey nuts.

C. Avellana, Linn.—Hook. Stud. Fl. 345, the common *Hazel*—*Hasel*, German; *Coudrier*, French, is a shrub with short-petiolate broadly ovate or rotundate leaves, hairy while young, and a single palmately-lobed involucre. Europe, Caucasus, Armenia, and Asia Minor. Ascends to 5000 ft. in Tyrol. The male catkins are formed in autumn, and open very early, between Jan. and April, long before the leaves are out. The Hazel is common in mixed coppice-woods in England, the North of France, and some parts of Germany. It requires a good deal of light, but thrives well under standards of Oak, Birch, and Ash. Makes excellent hoops. No heartwood, medullary rays broad, pores fine.

ORDER LXXIII. MYRICACEÆ.

Shrubs or trees, mostly aromatic, with alternate simple, exstipulate, generally serrate, coriaceous leaves with a prominent midrib and often resinous dots beneath. Flowers monoicous or dioicous, the male and female in catkins or spikes. Male fl.: Stamens 2-16, in the axil of lateral bracts, sometimes with 2 or more lateral bractlets; anthers 2-celled, the filaments often connate at the base. Female fl.: Perianth none; ovary 1-celled with 1 basal ovule, in the axil of a lateral bract, generally surrounded by 2-4 more or less adhering bracteoles; stigmas 2, sessile. Fruit a hard-shelled, 1-seeded nut, clothed with a fleshy or waxy pericarp. Seed exalbuminous, cotyledons fleshy, radicle superior.

1. MYRICA, Linn.

(Characters those of the Order.)

1. **M. sapida**, Wall. Tent. Fl. Nep. t. 45.—Vern. *Kaphal*, *kāephal*, N.W. Himal.; *Kobusi*, Nepal.

A moderate-sized (always?) evergreen dioicous tree, the current year's branchlets tomentose or pubescent. Leaves with a faint pleasant aromatic smell when rubbed or broken, alternate, lanceolate or oblanceolate, narrowed into a short petiole, those on older trees 3-5 in. long, entire, coriaceous, on the under side pale or rust-coloured, with numerous black resinous dots; petiole and midrib pubescent; main lateral nerves anastomosing by prominent intramarginal and reticulate veins. Leaves on young plants and shoots 5-8 in. long, membranous, with large and sharp serratures, and more numerous, prominent, main lateral nerves. Male catkins cylindric, ¼ in. long, sessile in lax axillary drooping racemes, as long as leaf or shorter. Female flowers in slender axillary spikes, styles red. Fruit a sessile ovoid drupe, several on axillary peduncles, ¾ in. long, tuberculate, pubescent while young, glabrous when ripe, with scanty reddish pulp, which is composed of cylindric or clavate fleshy hairs filled with red juice mixed with fine dry hairs or fibres. Nut rugose, pitted.

Himalaya, outer ranges, from 3000 to 6000 ft., extending north-west to the Ravi, but scarce beyond the Sutlej. Assam, Kasia hills. Not gregarious in the N.W. Himalaya, generally in mixed forests. The leaves are renewed in April and May; flowers generally in Oct.-Dec., the fruit ripening in May. It has, however, been found in flower in spring. Attains 30 ft., with a thick erect trunk. Bark dark- or brownish-grey, with deep vertical wrinkles. Wood pale-brown, heavy, compact, and hard. The fruit is eaten, and it is sold in the bazars of the hills, the pulp is scanty, but with a pleasant aromatic sweet and acidulous taste. The bark is the most valuable product of the tree; it is largely exported to the plains, used as an aromatic stimulant, and externally as a plaster against rheumatism (Pharm. Ind. 217).

Wallich identified this with a Japanese tree described by Kæmpfer (Amœn. Exot. 798) under the name of *Jubai* (vulgo *Jamma momu*). Hooker, Bot. Mag. t. 5727, is of opinion that it may be a variety of *M. Nagi*, Thunb. (*Na*, vulgo *Nagi, tsikkura siba*, Kæmpfer Am. Exot. 773, 874), to which he refers as a synonym *M. integrifolia*, Roxb. Fl. Ind. iii. 765; Wight Ic. t. 764, 765, a shrub or tree of Silhet, the Kasia hills, and Assam, with an ovoid drupe, the size of a prune, yellow when ripe, which ripens in May, is too sour to be eaten raw, but is pickled and used as a condiment. *M. Nagi*, Thunb., is synonymous with *M. rubra*, Sieb. et Zucc.; Benth Fl. Hongkong. 322; it is a large tree, not uncommon on the hills in Japan (vern. *Jamamo Noki*), and much cultivated on account of its deep-red purple acidulous fruit in Japan and China, which is eaten raw and cooked. The characters by which these three species are generally distinguished are as follows: male catkins simple, not paniculate in *M. Nagi*, paniculate in *M. integrifolia* and *sapida*, the partial catkins short, few-flowered, closely approximate in *M. integrifolia*, with the bracts larger, as long as or longer than the stamens. The number of stamens varies. Dr Hooker's view is probably correct, and when it is fully established, the North Indian tree must then be called *M. Nagi*, Thunb., with a wide range, from the Panjab to Japan, and from China to the sea-coast of Singapore and Borneo, where it grows as a shrub 12 ft. high.

Myrica Gale, Linn.; Hook. Stud. Fl. 347, *Sweet Gale*, or *Bog Myrtle*, is a deciduous gregarious aromatic shrub in peat-bogs, moors, and wet places of Britain, North and Central Europe, North Asia, and North America, which flowers before the leaves come out in April, May, and ripens its fruit (compact resinous spikes) in August.

The following, and probably several other species of this genus yield vegetable wax, which forms the outer covering of the fruit: 1. *M. cerifera*, L., *Bayberry* or *Wax Myrtle*, a small shrub of North America, shores of Lake Erie and sea-coast to Florida, with numerous small nuts encrusted with white wax. 2. *M. cordifolia*, L., the *Wax Myrtle* or *Candleberry* bush of dry sand-hills in South Africa and the Cape of Good Hope. Leaves ovate-dentate with cordate base, fruit ½ in. diam. 3. *M. arguta*, Kunth., a monoicous evergreen shrub on the mountains of Venezuela and New Grenada, and the Andes of Ecuador, Peru, and Bolivia.

ORDER LXXIV. **JUGLANDEÆ.**

Trees, rarely shrubs, with alternate pinnate often aromatic leaves without stipules. Flowers monoicous, the male in lateral catkins, the female solitary, clustered in erect or drooping spikes. Male fl.: Stamens 3-10, inserted on lateral bracts, generally surrounded by 3-6 membranous scales; anthers 2-celled, filaments short. Female fl.: Perianth adnate to ovary, sometimes enclosed by foliaceous bracts, connate and cup-shaped at the base; ovary 1-celled with 1 erect ovule. Fruit a 1-seeded 2-valved nut, often incompletely 2- or 4-celled at the base, and enclosed by a coriaceous or fleshy pericarp, which remains attached to the nut or eventually separates from it. Seed without albumen, cotyledons fleshy, oily, sinuous or corrugated, 2-lobed, radicle short, superior.

Fruit a large woody nut, enclosed in a thick coriaceous-fleshy pericarp, which separates from it when ripe . . . . 1. JUGLANS.
Fruit small, enclosed in large foliaceous bracts, in drooping spikes; pericarp not separating from the nut . . . 2. ENGELHARDTIA.

This small but remarkable family, which has great analogy with *Pistacia* among *Anacardiaceæ*, except the free ovary and curved embryo of the latter, contains, besides these two genera, the following: 1. *Carya*, inflorescence similar to *Juglans*, but male flowers fasciculate, and petals of the female flowers wanting; *C. alba*, Nutt., and several other species of this North American genus (hardy in England) furnish valuable timber, and yield the well-known *Hickory-nuts*. 2. *Platycarya strobilacea*, Sieb. & Zucc. (*Fortunea chinensis*, Lindl.), a tree of Japan and China (hardy in England), with the female flowers at the base of the male catkins, forming a cone when in fruit. 3. *Pterocarya fraxinifolia*, Spach, a tree of Armenia, the Caucasus, and North Persia (hardy in England), with 12 pair of serrate leaflets, the male catkins at the base of the female flower-spikes, which are long, lax, and drooping, the fruit with 2 broad lateral wings.

1. JUGLANS, L.

Aromatic trees. Leaves imparipinnate; petioles broad-based, leaving large scars on falling. Male flowers in lateral catkins from the axils of fallen leaves, on the previous year's wood. Perianth of 3-6 unequal lobes inserted on a lateral bract. Stamens 10-40, filaments free, very short. Female flowers solitary or several together at the ends of branches; calyx tubular, adhering to the ovary, 4-toothed, 4 small petals in the sinus between the teeth. Stigmas 2, more or less fleshy, fimbriate. Fruit with a thick coriaceous or fleshy pericarp, enclosing a hard woody, mostly irregularly-furrowed endocarp or nut-shell. Embryo sweet, edible.

1. **J. regia**, Linn.; Roxb. Fl. Ind. iii. 631.—*Walnut—Noyer*, French; *Wallnuss*, German. Sans. *Akshota, ākhota*. Pers. *Chārmaghz* (four brains or kernels), used in Kashmir and Afghanistan. Vern. *Akhrot*. Local names: *Ughz, waghz*, Afghanistan; *Akhor, khor, krot, dūn*, Kashmir; *Kābotang, thānka*, Pb.; *Starga*, Ladak; *Kā*, Kunawar; *Akhor, khor, kharot, korot*, Jaunsar and Kamaon.

A large tree, youngest shoots velvety or with floccose pubescence. Leaflets elliptic-oblong, entire (rarely serrulate), subcoriaceous, glabrous, with tufts of hairs in the axils of nerves beneath, main lateral nerves prominent, 15-20 pairs; terminal leaflet largest, petiolulate, the lateral, 3-4 sometimes 5-6 pair, subsessile, nearly opposite, those near the base smaller; common petiole 6-12 in. long, glabrous or hoary. Male catkins appearing with the leaves in the previous year's axils and on the previous year's wood, sometimes in pairs, green, pubescent, cylindric, 2-5 in. long; bracts pedicellate, oblong, with 6 perianth-lobes and 10-20 stamens, the buds of the coming year's catkins being ready-formed in the leaf-axils. Female flowers 1-3, limb of calyx minute, indistinctly toothed, petals linear-lanceolate, green, varying in length, sometimes half the length of ovary. Fruit green, ovoid, glabrous, 2 in. long, enclosing a brown, irregularly-furrowed nut, which is 2-valved, acute at the upper end and divided by 2 thin coriaceous dissepiments into 4 incomplete cells, one dissepiment separating the 2 cotyledons, the other dividing them at the back into 2 lobes. Seed with 2 integuments, the outer yellowish brown, the inner white, very fine.

Of the varieties described in DC. Prodr. xvi. ii. 136, the following may be mentioned. *α. tenera*, shell of nut thin, fragile. *β. beloudchistana*, leaflets 2 pair, entire, the terminal leaflet 8-10 in. long. Beluchistan near Quetta (a few trees only, Stocks). *γ. kamaonia*, petiole rusty-tomentose, leaflets oblong-lanceolate, entire, 6·9 in. long, fruit pubescent, shell of nut thick and very hard. Kamaon and Jaunsar (cultivated, and wild on the head-waters of the Dharaghad, June 1873, D.B.)

Wild in many forests of the North-West Himalaya and in Sikkim; also, according to the generally received opinion, in trans-Caucasia and probably in Armenia. C. Koch, however (Dendrologie, i. 584), states that the tree is not wild in either of these countries or in Asia Minor, and suggests that its home may possibly be found in Central Asia. Cultivated in Afghanistan, Beluchistan, on the hills in the trans-Indus territory, at 5000-6000 ft. near villages; abundantly in Kashmir, in the North-West Himalaya between 3500 and 10,000 ft., both in the outer ranges and in the inner arid tract, in Nepal, Sikkim, and the Kasia hills. In Kunawar its upper limits are Spui on the right and Namgia on the left bank, and in Nubra it is cultivated up to nearly 11,000 ft. Grown and bears fruit in gardens in Peshawar, grows but does not bear fruit in Calcutta. Commonly cultivated in Europe and Western Asia. In Western Europe the Walnut is grown nearly to 58° N.L. in Ross-shire, but only in sheltered places. Near Edinburgh the tree grows with vigour, but ripens its fruit only in the finest and hottest summers (Selby, British Forest Trees, 44). On the east side of Europe it is found to 52°. It was known to the ancients, and Pliny states that it was brought from Persia (A. De Candolle, Geographie Bot. 393, 968). Leafless in winter, the new foliage comes out from Feb. to April, according to elevation, and the flowers appear about the same time. The fruit ripens July-Sept. Attains, under favourable circumstances, 80-100 ft. and a girth of 10-15, and not rarely of 20 ft. Instances of large trees are: 22 ft. girth at Sāli on the Chenab at 8200 ft.; 28 ft. Kullu, Stewart; 17 ft. and 100 ft. high, Tutwa forest, Dharaghad, Jaunsar, D.B. Old trunks are often buttressed. In Ladak the trees have short trunks not exceeding 7-8 ft. girth, with a low rounded crown. Bark ½ in. thick, silvery or dark grey, sometimes mixed with reddish brown. Sapwood greyish white. Heartwood brown or greyish brown, often veined with darker shades, darker near the centre. Weight, 40-48 lb. (Europe). Medullary rays short, moderately broad, numerous. Pores equal in size and uniformly distributed, solitary or in radial groups of 2-4, annual rings distinct; besides the annual rings, numerous minute concentric lines. The heartwood is very durable, works well and does not warp or split; it is a beautiful furniture-wood and polishes well; the principal use is for gun-stocks. It is also used for turning, and in Kashmir much of the lacquered ware is made of it. The bark is largely exported to the plains, and sold, under the name of *dandāsa*, to clean the teeth and strengthen the gums. It is also used (on the Bias) as a dye-stuff and in native medicine. The twigs and leaves are used as winter fodder, which, with hay, is often stored on the large boughs of the tree. On the Sutlej it is said that trees which are lopped for fodder will continue yielding fruit, provided they get rest every fourth year. The nut, however, is the most important product of the tree; that of the wild tree has a thick, extremely hard shell with a small kernel, which is rarely eaten: the cultivated varieties are numerous, one much valued in Kashmir is called *kaghazi* (paper-shelled). Where the tree is most commonly cultivated, in Kashmir, Pangi, and Kunawar, Walnuts form an important article of food. They are also exported largely to the plains, to Bengal, and the rest of India. Oil is made of them in Europe and in India. The outer covering of the fruit is employed as a dye in Kashmir; in Europe it is used for tanning, as well as the bark of the tree. The tree produces fruit at an early age. On the

Chenab and in Kunawar it does not ripen its fruit well at an elevation above 9500 ft. The wild Walnut merits cultivation as a forest-tree on account of its timber; when grown in compact masses it cannot be expected to produce much fruit, but the timber would probably prove one of the most valuable of the leaf-bearing trees of the North-West Himalaya, and it has the advantage of not being too heavy for floating. The tree, however, requires a rich and deep soil, and will probably not prove to be a rapid grower.

J. nigra, L., the *Black Walnut*, sometimes called *Black Hickory*, of North America, particularly in Ohio and Kentucky, south to Florida and Texas, has serrate, ovate-lanceolate, long-acuminate leaflets, and a spherical incompletely 4-celled nut. Wood beautifully veined, valued for furniture, heavier than that of *J. regia* (lighter according to Nördlinger, Techn. Eigensch. d. Holzes, 522).

J. cinerea, L., the *Butter-nut* of Canada and the Northern States, has oblong-lanceolate, downy leaflets, an oblong nut, 2-celled at the base.

2. **ENGELHARDTIA,** Leschenault.

Resinous trees or large shrubs. Leaves sometimes apparently paripinnate by the abortion of the terminal leaflet. Male flowers in cylindric lateral catkins. Perianth of 3-6 lobes, adnate to a lateral generally stipitate often 3-lobed bract. Stamens 4-12, anthers subsessile. Female flowers in long drooping bracteate spikes. Calyx adnate to the ovary with a 4-dentate limb. Petals none. Stigmas 2, sessile, linear, papillose. Bract cup-shaped, enclosing the flower, limb divided into 4 unequal segments, the inner rounded, often crenate, the three outer membranous, veined, generally oblong, the middle one longest. Fruit small, enclosed by the enlarged bract; pericarp thin, firmly adhering to the endocarp.

1. **E. Colebrookiana,** Lindl. in Wall. Pl. As. rar. t. 208.—Vern. *Tīmar rūkh*, Pb.; *Mowa, gobar mowa, bodal mowa*, Kamaon; *Khusam*, Banda.

A large shrub or moderate-sized tree, the current year's branchlets tomentose or pubescent. Leaves generally approximate near the ends of branches, mostly imparipinnate, leaflets 3-5 pair, nearly opposite or alternate, shortly petiolulate, elliptic-oblong, obtuse or acute, base unequal-sided, subcoriaceous when full-grown, pubescent or tomentose when young, the upper side glabrous when full-grown, the under side tomentose or with minute round yellowish scales; main lateral nerves 10-15 on either side of midrib, joined by prominent reticulate and intramarginal veins. Male catkins numerous, 3-5 in. long, generally clustered at the base of the female spikes. Bract stipitate, more or less 3-lobed, bearing 4-5 oblong obtuse scales, one generally at the base, the others at the top or along the sides of the bract, and 6-8 sessile hispid mucronulate anthers. A tuft of hairs, in the place of a rudimentary ovary, not rarely between the anthers. Female spikes pedunculate, 5-6 in. long, drooping, lax when in flower, cylindric, compact when in fruit, outer bracts in fruit spathulate-oblong, obtuse, the middle one 1-1¼ in. long, the two lateral ones half that length, each with a prominent midrib, and reticulate veins, with minute round scales, glabrous or pubescent, the inner bract irregularly dentate, hispid with long stiff hairs.

Siwalik tract and outer North-West Himalaya, ascending to 6500 ft., common and often gregarious, covering large areas on dry hillsides in Kamaon and Garhwal, extending to the Chenab, but scarce west of the Jumna. Kalliangarh hills in the Banda district. Leafless during part of winter; the flowers appear with the young leaves in March and April, and the fruit ripens in May. Bark light or dark grey. Attains a girth of 4-5 ft. in North-West India.

Farther researches on the spot will probably show that this species is only a tomentose and small-sized variety of *E. spicata*, Blume Flora Javae. t. 1, 5, of Nepal, Sikkim, East Bengal, Burma, and the Indian Archipelago. In Java this is a gigantic tree, 150-200 ft. high, with pale-red, hard, and heavy wood, made into (solid) cart-wheels and gigantic cattle-troughs. The leaves are more glabrous, the leaflets more oblong and acuminate, petiolate or sessile, the female spikes are 12-20 in. with bracts 2 in. long, and the male catkins 4-8 in. long. The bracts of the male flowers often terminate in a mucro, and they are sometimes abnormally lengthened out into a 3-lobed bract, similar in appearance to the outer lobes of the female bracts. The scales attached to these bracts vary in size and shape, from linear-oblong to triangular, and the number of stamens in one flower is between 4 and 10. In the female flower the styles are sometimes bifid.

E. Roxburghiana, Lindl. in Wall. Pl. As. rar. t. 199—Syn. *Juglans pterococca*, Roxb. Fl. Ind. iii. 631—is difficult to identify. Roxburgh's figure exactly represents the habit and fruit of *E. spicata*, Blume, for which it is probably intended. Casimir De Candolle identifies it with that tree, but the representation and description of the male flower is entirely different. Roxburgh describes and figures (Ill. in Herb. Kew, 2395, copied in Pl. As. rar.) the male flower as consisting of 4 regular scales or sepals, with 3 stamens at the base of each, and in the plate these stamens surround what appears to be intended for a rudimentary ovary. The female flower-spikes also are erect, and not longer than the male catkins. I have seen no specimens at all corresponding to the plate, and probably there was a mistake in the original drawing. Wallich's specimens from Nepal marked *E. Roxburghiana*, agree with *E. spicata*, Blume. It seems remarkable that Wallich, who was acquainted with the tree, should have overlooked the error in the original drawing when publishing it in his Asiatic Plants. Roxburgh states that the bark of *Juglans pterococca* is thick, dark-brown, possessing much tannin, and is reckoned by the natives (of Silhet, where it is called *Bolas*) the best they are acquainted with for tanning.

ORDER LXXV. GNETACEÆ.

Shrubs, climbers, undershrubs, rarely trees, the branches articulated at the nodes. Leaves opposite (*Gnetum*) or rudimentary, consisting of a 2-lobed sheath (*Ephedra*). Flowers monoicous or dioicous, in heads or spikes. Male flowers consisting of 2-8 monadelphous stamens, enclosed in a 2-fid sheathing perianth; filaments connate into a fleshy column; anthers 1- or 2-celled (3-celled in the abnormal genus *Welwitschia*). Female flowers consisting of a naked ovule, enclosed by a sheathing or imbricate bract, and several integuments, one of which is often prolonged into a filiform appendix resembling a style. Fruit 1- or 2-seeded, enclosed in the more or less succulent, persistent fleshy bracts. Embryo in the axis of a copious albumen, with 2 foliaceous cotyledons, radicle superior.—Royle Ill. 347.

1. **EPHEDRA**, Tourn.

Shrubs or undershrubs with nodose stems, and articulate opposite or whorled branches. Wood analogous in structure to the wood of conifers, composed of rays and wood-cells with discs. Leaves reduced to a membranous sheath with 2 opposite, sometimes linear lobes. Flowers dioicous, rarely monoicous, in terminal and lateral short, bracteate, sessile or pedunculate spikes, opposite in pairs or whorled. Male flowers in the axils of opposite bracts, forming an ovoid 4-20-flowered spike; anthers 2-10, two-celled, opening by pores at the top. Female spike of 2 flowers, rarely 1, enclosed by a membranous bifid or bipartite sheath, surrounded at the base by numerous imbricate bracts. Seeds two, flat on the inner, convex on the outer face, rarely 1 seed only.

Branches erect, internodes 1·2 in. long; anthers 6-10, stipitate; tube of inner sheath of female flowers short, included within the outer bracts, bifid, lobes exserted	1. *E. vulgaris.*
Branches slender, flaccid, sometimes scandent, internodes 1-4 in. long; anthers 2-5, sessile; tube of inner sheath of female flowers exserted, truncate or indistinctly 2-lobed . .	2. *E. Alte.*

1. **E. vulgaris**, Rich.; DC. Prodr. xvi. ii. 354.—Syn. *E. monostachya*, and *distachya*, Linn.; Reichenb. Ic. Fl. Germ. t. 539. Vern. *Asmānia*, *būdshūr*, *būtshūr*, *chewa*, Pb.; *Khanda*, *khanna*, Kunawar; *Tse*, *tsapatt*, *trano*, Ladak.

A small rigid shrub, branches green or brownish, cylindric, with numerous raised scabrous lines, internodes 1-2, sometimes 2½ in. long, sheaths yellow or brown, with a white membranous edge and 2 acute teeth, shorter than sheath. Male spikes yellow, subsessile, in lateral or terminal, often whorled clusters; anthers 6-10, the inner ones stipitate. Female spikes lateral or terminal, in pairs or whorled clusters, subsessile or short-pedunculate; tube of inner sheath short, included within the outer bracts, 2-fid, lobes exserted. Fruit ovoid, succulent, sweet, pale- or bright-red when ripe, ¼ in. long, seeds 2.

Dry stony hills, Afghanistan and Beluchistan, inner arid and intermediate Himalaya, Jhelam, Chenab, and Sutlej, between 7800 and 12,800 ft. (Urni the lower limit in Kunawar), West Tibet to 16,600 ft. (Stewart), inner Kamaon and inner Sikkim, and adjoining parts of Tibet, ascending to 16,000 ft., South Europe, North Africa, Western Asia, Caucasus, Siberia. Fl. April-June, later at high elevations; the fruit ripens Aug.-Oct. At high elevations, often not more than a few inches high, lower down attains 2-4 ft., with woody, often gnarled, stems, and numerous, opposite or whorled, straight erect, and often tuberculate branches. Bark grey, rugose, inner substance fibrous, brown, very tough. Wood whitish-yellow. The fruit, which looks pretty, clustered on the dark-green branches, is very sweet, and is eaten in some places—*e. g.*, on the Sutlej. The branches are browsed by goats, the Yak does not touch them. In the treeless parts of Ladak the woody roots and stems are used as fuel.

2. **E. Alte**, C. A. Meyer—**Tab. LXIX.**—Versuch einer Monographie d. Gattung *Ephedra*, St Petersburg, 1846, 75.—Syn. *E. ciliata*, Fischer

et Meyer. Arab. *Alte.* Vern. *Kuchan*, *nikki* (small), *kūrkan*, *bratta*, *tandala*, *lastūk*, *nangarwal*, Pb.

A shrub with slender flaccid, generally whorled branches; branchlets often filiform, with numerous raised longitudinal lines, often rough with short hairs, internodes 1-4 in. long, sheaths very short, with two triangular or linear teeth longer than sheath, often prolonged into narrow linear leaves. Male spikes sessile, in lateral or terminal, often whorled clusters; anthers 2-5, sessile. Female spikes pedunculate, solitary or in pairs; tube of inner sheath exserted, truncate or indistinctly 2-lobed. Fruit ovoid, succulent, tasteless, ¼ in. long, red when ripe.

Plains of the Panjab and Sindh, ascending in the Salt range to 3000 ft. Afghanistan, Persia, Arabia, Aden, Sinai. Madden, As. Soc. Journ. xvii. i. 404, mentions an *Ephedra* in Rajputana (Vern. *Phōk*, generally the name of *Calligonum polygonoides*); if an *Ephedra*, it probably is this species. Somewhat gregarious, forming dense clumps of low brushwood in the most arid, sandy or stony places; branches brown or somewhat glaucous, often scandent on other trees. Fl. March, April (sometimes in October); the fruit ripens in May, and is often long persistent. Bark brown, bunches of stem and branches are sometimes used for cleaning brass dishes.

E. alata, D$^{\text{ne.}}$; DC. Prodr. 358, is a much larger shrub, 9-10 ft. high, with stiff erect branches, marked by having bracts and sheath of female flowers with a broad white membranous margin, the inner sheath of the female flowers nearly 2-partite to the base, and 3-8 subsessile anthers on a long-exserted column. Deserts of North Africa, from Algeria to Egypt, Sinai, Persia.—Aitchison (Cat. 142) quotes "Edgeworth, Multan." I have not seen specimens; Edgeworth in Florula Mallica Journ. Linn. Soc. vi. 194, enters *E. alata* (without auth.), which may possibly be intended for *E. alata*, Schimp., a synonym of *E. Alte.*

Gnetum scandens, Roxb. Fl. Ind. iii. 518—Syn. *G. edule*, Blume; Vern. *Kūmbal*, *ūmbli*, Bombay—is a stout climbing shrub, with opposite coriaceous elliptic-oblong petiolate leaves, 5-6 in. long, which turn black in drying; flowers monoicous in cylindric verticillate, paniculate spikes, with numerous short annular sheaths, the flowers mixed with articulate hairs closely packed in their axils. Male flowers monandrous, anthers of 2 distinct cells, opening by a slit at the apex, at the end of a thick column, protruding from a thick clavate angular sheath, which splits in two. Female flowers consisting of numerous naked ovules similarly arranged, and mixed with articulate hairs. Fruit an oblong 1-seeded drupe, 1-1½ in. long, narrowed into a thick short stalk, red when ripe. The seeds are eaten. Common in the dense forests of the Western Ghats and the Konkan—East Bengal, Burma, Indian Archipelago, China. The wood of *Gnetum* consists of a large number of distinct wedge-shaped ligneous masses, which are arranged in concentric circles, and separated by cellular tissue. It thus resembles the wood of *Menispermaceæ* (p. 10).

Order LXXVI. **CONIFERÆ.**

Shrubs or trees, generally evergreen and resinous. Wood without vessels, hence on a horizontal section without pores, consisting of medullary rays and long thick-walled wood-cells, tapering at the ends, with circular discs (lenticular cavities between the walls of adjoining cells), on the sides parallel to the rays; in the wood of roots on all sides. The turpentine (resin) is generally secreted in large, branching, intercellular ducts lined by thin-walled cells, either in the bark, or in the wood, vertical in the mass of wood-cells, and horizontal in the medullary rays. The annual rings are, as a rule, distinctly marked by a belt of thick-walled wood-cells in the outer (autumn) wood, and a belt of larger wood-cells with thin walls in the inner (spring) wood of the succeeding year. In many coniferous woods the inner belt of each annual ring is soft, and the outer belt compact and hard. Leaves alternate, rigid, scale-like, subulate, acicular or linear, rarely with a broad blade; without stipules. Flowers monoicous or dioicous, without perianth. Male flowers in deciduous catkins. Female flowers solitary, capitate, or in spikes (cones), consisting of one or several ovules adnate to, or surrounded by carpellary scales. Albumen fleshy and oily (in *Araucaria* farinaceous); cotyledons generally more than two, whorled.—Royle Ill. 348.*

According to Parlatore, in DC. Prodr. xvi. ii., this Order comprises 216 species. Those of North-West India belong to the following tribes:—

Abietineæ (*Pineæ*, Parlatore).—Fruit a cone, with numerous imbricate, carpellary, generally woody scales, each bearing at its base two seeds (developed from inverted ovules) and inserted in the axil of a bract, the bract often dry and not apparent when the fruit is ripe—*Pinus, Cedrus, Abies, Larix.*

Cupressineæ.—Fruit with few carpellary scales, varying in shape and substance, sometimes fleshy, each bearing at its base, or on the stalk when the scales are peltate, 1 or numerous seeds (developed from erect ovules). No bracts—*Cupressus, Juniperus, Callitris, Biota.*

Taxineæ (a distinct Order of many botanists).—Fruit 1-seeded (1 erect ovule), supported by a few imbricate scales—(in *Taxus* surrounded by a fleshy cup-shaped disc) *Taxus, Podocarpus.*

There are two other tribes—*Araucarieæ* and *Taxodieæ*—to which the following remarkable trees belong: *Araucaria Bidwilli*, Hook., the *Bunya Bunya* of the aborigines of North-East Australia in 27° S.L. A tall tree with a straight stem and numerous tiers of short rigid whorled branches. The cones, which are said to ripen every third or fourth year only, are nearly as large as a man's head, and contain numerous large farinaceous seeds, which are an important article of food of the inhabitants. The cones of *Araucaria* consist of numerous imbricate carpellary scales, each scale with only 1 seed at the base.

The seeds of *A. imbricata*, Pavon, are also eaten. This tree grows on the higher mountains of Chili (36°-48° S.L.), is hardy, though it is occasionally injured by severe frost, and extensively cultivated in England, where it was introduced in 1796, the highest specimen being at Dropmore, 50 ft. high in 1871. This, like the other species of this genus, continues its growth throughout the year; the buds are open, not enclosed in scales; and young leaves are being formed at all times of the year. The wood of some *Araucarias* is supposed to have no proper annual rings; the concentric bands are often incomplete, and are believed not to indicate any periodical interruption of the vegetation, like that which causes the formation of annual rings of other coniferous and leaf-bearing trees.

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* Regarding the Coniferous trees of the N.W. Himalaya, the following papers in the Journ. Agric. and Hortic. Society of India contain much valuable information: Madden, Observations on some of the Pines and other Coniferous Trees of the Northern Himalaya, and on Himalayan Coniferæ, vols. iv. and vii., 1845, 1850; Cleghorn, Notes upon the Pines of the N.W. Himalaya, vol. xiv., 1866. Of official reports, the report on the Deodar forests of Bussahir, by D. Brandis, J. L. Stewart, and Capt. E. Wood, Calcutta, 1865, contains most information on the growth and natural history of the Himalayan Conifers.

The tribe of *Taxodieæ* includes, besides many other interesting trees of North America, Japan, China, Australia, and South Africa, the two giants of California, *Sequoia sempervirens*, Endl., and *S. gigantea*, Torrey (*Wellingtonia gigantea*, Lindley). The former, the Redwood of the coast, is found in a narrow belt between 34° and 42° N.L. in the mountains of California; it has been known to attain 300 ft., with a girth of 55 ft. Its cones are 1 in. long, the timber is excellent, and it coppices vigorously.

Sequoia gigantea, the *Wellingtonia* or *Mammoth-tree*, is well known as the reputed tallest tree on record, attaining 300 to 330 ft., and a circumference of 80-100 ft. One individual is stated to have been 450 ft. high. As regards height, *Eucalyptus Globulus* and *obliqua* of Tasmania, and other Australian *Eucalypti* (p. 231), rival the Californian tree. *Abies Douglasii* (p. 527) and *Sequoia sempervirens* probably stand in the second rank; and *Antiaris innoxia* (p. 427), with the *Deodar* (p. 518), under exceptionally favourable circumstances, take the third. Of European trees the *Silver Fir* (p. 529) comes next, but it rarely attains, even in the most luxuriant and compact forests of the Southern Schwarzwald, 200 ft. Eng., one-half the height of the *Wellingtonia*; and it remains considerably behind the great variety of trees which compose the dense evergreen forests of Tenasserim and of the crest of the Western Ghats (where not cleared for coffee plantations), which often form a dense mass of vegetation, unbroken for miles, on an average 200 ft. high.

The *Mammoth-tree* has a much more limited range of distribution than any of the other forest giants just mentioned. Like the *Deodar*, *Pinus excelsa*, and the *Larch* of the Alps and Carpathians, it is an inhabitant of the mountains, but, so far as known at present, it is only found in a belt 25 miles long in N.L. 38°, in the valleys on the west side of the Sierra Nevada of California at an elevation of 4000 to 7000 ft.

The wood of the *Mammoth-tree* has distinct concentric rings, the inner belt of each being composed of soft spongy wood, while there is a narrow but hard and horny outer belt of darker colour. It has been asserted that two or more of such rings are formed in one year. The cones of *S. gigantea* are 2-2½ in. long; they consist of imbricate scales, like the cones of *Abietineæ*, but each scale has 5 seeds at its base. Both *Sequoias* are hardy in England.

Fruit a cone with imbricate scales.

Leaves persistent, in clusters of 2-5, in the axils of membranous scales; cones ripen the 2d, sometimes the 3d year, scales thickened at the apex . . . . . . 1. PINUS.

Leaves persistent, numerous, in tufts at the ends of arrested branchlets; cones requiring 2 years to ripen, scales broad with a thin sharp edge . . . . 2. CEDRUS.
Leaves persistent, single, not in tufts; cones ripening the same year; scales with a thin sharp edge . . . 3. ABIES.
Leaves deciduous, in tufts; cones ripening the same year; scales with a thin sharp edge . . . . . . 4. LARIX.
Fruit woody subglobose, with peltate scales, tightly closed before maturity; leaves persistent, closely adpressed, scale-like and imbricate, or subulate . . . . . 5. CUPRESSUS.
Fruit fleshy.
Female catkins ovoid, of 3-6 coalescent scales, fleshy in fruit, ripening the second year forming a 1-3-seeded berry . 6. JUNIPERUS.
Female flowers solitary, consisting of an erect ovule seated on a fleshy disc, which enlarges into a fleshy cup surrounding the seed . . . . 7. TAXUS.

1. PINUS, Linn.

Evergreen monoicous trees, the branches generally in whorls at the base of each year's terminal shoot. Leaves on the first shoots of seedlings and on elongating branchlets single, acicular subulate or squamiform, bearing in their axils arrested branchlets, consisting of a short, tubercular axis, and a number of membranous sheathing scales which surround a cluster of 2-5 acicular leaves. Axillary buds are as a rule only developed into elongated branches at the end of each year's terminal shoot, one whorl of side branches being formed annually, so that the age of a young tree may be ascertained, not only by counting the annual rings of the wood, but also by the number of whorls on the stem. There are, however, exceptions: *Pinus excelsa* and *Pinaster* often form two whorls in one season, and *P. Gerardiana* and others are apt to throw out scattered side branches, not in regular whorls. The male catkins are in the axils of membranous bracts, clustered round the branch in a dense raceme at the base of the current year's shoot, so that in those branches, which habitually bear male flowers, there are often breaks in the foliage indicating the position of previous year's catkins. Antheriferous scales numerous, imbricate, each scale with 2 distinct anther-cells on its under surface, prolonged beyond them into a membranous crest. Female flowers on separate branches, solitary or in whorls, generally at the end of the current year's shoot, subsessile or pedunculate, peduncle with scaly bracts. Ovules inverted, in pairs at the base of the carpellary scales, each scale in the axil of a bract which disappears before the fruit ripens. Cones sessile or stipitate, formed of the enlarged woody carpellary scales, which are more or less thickened at the apex. Seeds oily, with a hard woody testa, in shallow excavations at the base of the scales, often winged. Cotyledons 3-12, linear.

Leaves in clusters of three; cones ovoid or ovoid-conical.
Sheathing scales persistent, fimbriate at the edges; seeds with a large wing . . . . 1. *P. longifolia.*
Sheathing scales deciduous; seeds with a short caducous wing . . . . 2. *P. Gerardiana.*
Leaves in clusters of five; sheathing scales deciduous; cones cylindric, scales not much thickened at the top . . 3. *P. excelsa.*

A two-leaved Pine is described under the name of *P. Royleana*, Jameson (Report upon the Bot. Gardens of the N.W. Provinces, 1854, p. 43, and Journ. Hort. Soc. 1855, 52). The cones, of which a number are in the Kew Museum, are ovoid-conical, 2 in. long, the ends of the scales with a sharp hook similar to the cones of some varieties of *P. sylvestris*. The leaves (which I have not seen) are described as 2 in a sheath, 2-2½ in. long, stiff and light glaucous green, sheaths short and partially persistent. Seeds very small with a broadish wing, rather more than ½ in. long. Cotyledons 6. Jameson states that it was discovered in 1850 by the Garden Seed Collectors on the Gosainthan mountain in Nepal, at an elev. of 10,000 ft. above the sea. Seeds were sent to England, from which plants were raised in the Hort. Soc. Garden in 1853, but this is all that is known regarding this doubtful species, which Parlatore doubtfully suggests might be *P. Kasya* (DC. Prodr. xvi. ii. 390), but it evidently is closely allied to *P. sylvestris*. Another doubtful species, classed by Parlatore under the 2-leaved Pines, is *P. persica*, Strangways (Loudon's Gardeners' Magazine, 1839, p. 130), shape of the cone said to be like that of *P. Pinea*, seeds large, with gibbous wings. Under this name a 2-leaved Pine is cultivated at Kew, believed to be *P. halepensis*. Parlatore describes it with cylindric obtuse cones, and the leaves in threes and fours.

1. **P. longifolia**, Roxb. Fl. Ind. iii. 651; Cleghorn, Pines of the N.W. Himalaya, t. 3; Royle Ill. t. 85. Sans. *Sarala*. Vern. *Nakhtar* (*shāutāi*, splinters of wood), Afg.; *Chīl*, *chīr*, *drāb chīr*, Pb.; *Saral*, Jaunsar; *Chīr*, *salla*, *sapin* (straight tree), *kolon*, *kolan*, *kolain*, *kallon*, Garhw., Kamaon; *Thansa*, Royle, N.W. Him.; *Dhūp*, Oudh. In Sikkim called *Gniet-kūng* by the Lepchas, and *Teadong* by the Bhotias.

A large tree with symmetrical branches high up on the trunk, forming a rounded head of light foliage. Bark rough, cut into polygonal plates by deep dark-coloured furrows. Leaves in clusters of three, 9-12 in. long, sometimes longer, slender, inner face keeled, so as to be nearly triquetrous, with a rounded convex back. Sheath persistent, greyish brown, of numerous closely imbricate bracts, fimbriate at the edges with long fibres. Cones on short stiff stalks, spreading or recurved, solitary or in whorls of 3-5, ovoid-conical, 4-7 in. long, 3 in. diam. above the base. Scales 1½-2 in. long, ¾ in. broad, and ½ in. thick at the top, the apex (apophysis) forming a spreading or recurved obtuse pyramidal beak, with 4-6 more or less distinct rounded faces. Seeds with a thin membranous wing ½-1 in. long, obtuse, oblanceolate and unequal-sided. Cotyledons 12 on the average (Madden).

Afghanistan, cultivated at Kandahar, 3500 ft. Kafiristan at 6000 ft. Eastern slopes of the Suliman range, where Dr Stewart, in 1860, supposed its lower limit to be over 9000 ft., Pb. Pl. 226. Abundant in the Siwalik tract and outer Himalaya from the Indus to Bhutan, generally between 1500 and 6000 ft. elevation, occasionally ascending higher, to 7500 ft. in Kamaon. The lower and upper limits of this tree in the different parts of the Himalaya, under different circumstances, are by no means well known. In the Panjab, north of the Sutlej, 1800 ft. is generally regarded as the lowest, and 5000 ft. as the upper limit; at Simla the tree grows as high as 7000 ft., and this is generally its upper limit in Kamaon. In Sikkim and Bhutan it does not rise beyond 3000 or 4000 ft. In the Sutlej valley this Pine skirts, in open forests, the trees standing far apart, the lower slopes of the hills on both sides of the Sutlej river as far as the Wangtu bridge, where it reaches its upper limit in the valley. Cultivated in the plains of North-

West India, and grows even at Calcutta. In England requires shelter in winter. Gregarious, forming nearly pure, open forests, often with scanty underwood of *Andromeda, Berberis, Rhus Cotinus*, and locally at lower elevations, of *Carissa diffusa*. Fl. Feb.-April; the cones require 12-15 months to ripen; they open and shed their seeds in April or May, but are long persistent afterwards, so that in autumn there are numerous seedless cones on the trees. Ribbentrop (Panjab Arboricult. 178) states that in the Panjab the seed ripens in October, and that the best time to collect seed is to pick the cones from Dec. to March. The leaves generally remain 2-3 years on the branches, the oldest being shed in May and June. Attains 70, and at times 100-110 ft.; trunk tall, erect, straight, 5-7, rarely 10-12 ft. girth. Crown oval when young, rounded when old, extremities of branchlets turned upwards, foliage of old trees dark, of young trees lighter green. Bark ½ in. thick, cut up by deep fissures and cracks into irregularly polygonal, sometimes oblong thick, large grey or reddish plates, inner substance reddish-brown, compact. Wood yellowish, reddish-white or brown, no distinct heartwood. The weight of seasoned Chīr, according to experiments made at Rurki, is 27 lb., and the value of P. 932 (average of 10 exp., extremes 818 and 1084). Experiments made at Almora by Capt. Jones in 1844, and recorded by Madden, give 34-45 as the weight of unseasoned wood felled one month, P=626 (15 exp.), and 36-41 lb. for seasoned timber, P=545 (5 exp.) The wood is easy to work, and is extensively used in the hills for building—roof-trees are said to last two generations in Kamaon—also for shingles where slate is not available, at the tea plantations for tea-boxes, and there is a considerable export of it to the plains on several of the Himalayan rivers. On the Sutlej and Bias it is largely employed for the bottoms of boats. As a rule, however, the wood is not durable; it is attacked by insects, and decays rapidly when exposed to wet. In Kamaon, about Piūra, and in several places on the Wardwan branch of the Chenab, a large proportion of the trees have the bark and the fibres of the wood much spirally twisted, in the same way, only to a much greater degree than is often seen in horse-chestnuts in Europe. The wood of the twisted trees is useless for any purpose save fuel. It has been supposed that the twist is caused by the local winds, but the twisted are often mixed with straight-grown trees, exactly as is the case in an avenue of horse-chestnuts, and their occurrence is confined to particular localities not more exposed to the action of the wind than the neighbouring tracts.

The Chīr probably produces more turpentine and resin than the other Conifers of the North-West Himalaya; it is obtained by making incisions in the stem, or by stripping off the bark. The crude turpentine and resin is called *Biroza* or *gandha firoza*, generally in N.W. India, *dhūp* in Oudh, *berja* or *biroja* in Garhwal, and *khalja* near Simla. The Sanscrit word is *kshīra*, whence probably the name *chir*. In a report on the resinous products of the Garhwal Forest Division, of March 1867, R. Thompson states that the quantity of *berja* annually brought down to the markets at the foot of the hills may be assumed at between 1000 to 1200 maunds of 80 lb. each, at prices varying from 3 to 4½ rupees per maund,—and he describes the procedure as follows: "Several deep triangular-shaped niches are cut into and around the trunk of the tree. The niches are 12-18 in. long, and 6-8 in. deep. The base of the niche is hollowed out so as to form a sort of receiver for the resin after it exudes. These are emptied out as filled, which takes 10-15 days from the time of first cutting. The receivers are filled and emptied several times during the season, which lasts from 15th March to 15th June, or 3 months. The yield of an ordinary-sized tree is 10-20 lb. of *berja* for the first, and about a third of the quantity the second year, after which the tree either dies or is blown down." In the Panjab in 1868 the crude resin sold for 4-7 rupees per maund. Tar (mixed with turpentine and products of destructive distillation of wood) is also made by filling an earthen pot (perforated at the bottom with small holes) with chips of resinous wood, the pot is closed and luted over with wet mud, pieces of dry cow-dung are heaped over it, and lighted. This fuel burns slowly, and the tar runs into a second smaller pot placed underneath the other in a hole dug in the ground (Journ. As. Soc. ii. 249). Spirit of turpentine is distilled from the crude turpentine in the Panjab, the Bijnaur district, and elsewhere in North-West India; in the Panjab the crude turpentine to be distilled is mixed with water and carbonate of soda. The residue (pale resin, colophony) is called *sūndras* in Bijnaur. The wood of stumps and of trees which had been notched and mutilated is often so full of resin as to be translucent, and such wood is used for torches and in place of candles, in houses and mines. The bark is used for tanning, and as fuel for iron-smelting. Charcoal is often made of the wood. The charcoal of the leaves, mixed with rice-water, is used instead of ink. The seeds (*kalghoza, chalhatti*) are eaten, and are of some importance as food in times of scarcity; they have a strong taste of turpentine.

The *Chīr* requires much light, and seedlings will not spring up under shade. Nevertheless the regeneration of Chīr forests by self-sown seedlings is good, and will, with properly-regulated cuttings, probably not present any great difficulty wherever fires and cattle can be excluded. It is easily raised from seed, but regarding its cultivation on a large scale not much experience has yet been gained. Ribbentrop (Hints on Arboriculture in the Panjab, 179) states that the tree makes a long tap-root in its early youth, which must not be injured in transplanting. The growth is moderately rapid (4-5 rings per inch). It has much tenacity of life.

Nearly allied is *P. Kasya*, Royle; DC. Prodr. xvi. ii. 390, the Pine of the Kasia hills (2000-6000 ft.), and of the mountains east of Toungoo, between the Sitang and Yunzalin rivers in Burma, where I found it in Feb. 1859, forming extensive forests at elevations above 3000 ft., as a large tree, attaining 200 ft. in height, the wood very resinous. (*Tinyuben*; Burm.) It has shorter and more slender leaves (3 in a sheath), the young cones are recurved, on long bracteate stalks, the ripe fruit is smaller than that of *P. longifolia*, 2-3 in. long, the top of the scales flat or convex, without any prominent beak at the end. On the Yunzalin plateau, the male flowers open in Feb., and at that time cones of several stages of growth are on the trees. Of the tree in the Kasia hills Hooker gives the following account: "They had 5 years' old cones on them as well as those of all succeeding years; they bear male flowers in autumn, which impregnate the cones formed the previous year. Thus the cones formed in the spring of 1850 are fertilised in the following autumn, and do not ripen their seeds till the second following autumn, that of 1852."—Himalayan Journals, ii. 288. The time of impregnation of the female flowers of *P. longifolia* merits farther inquiry, also the time which the cones require to ripen. It would be remarkable, though not unexampled (see *Quercus Suber* and *occidentalis*), if two species so closely allied were found to differ in this respect.

2. **P. Gerardiana**, Wall.—**Tab. LXVII.**—Royle Ill. t. 85; Cleghorn l. c. t. 4. Vern. *Chilghoza, jalghoza*, Afg.; *Chiri, prita, mīrri, galboja, galgoja*, Chenab; *Kashti*, Ravi; *Ri, rhi*, Kunawar; *Kannuchi, koniūnchi, kaninchi*, West Tibet. Called *Konecha, kolecha*, by the Juwahir Bhutiyas (Madden). The **seeds**: *Neoza, nioza.*

A middle-sized tree with a short rounded crown and grey bark, peeling off in large flakes. Foliage dark green, branches smooth, nut-brown. Leaves in clusters of three, 3-5 in. long, stiff, ⅔ line broad; sheath and bracts deciduous. Cones while young (catkins) erect on stout scaly peduncles 1 in. long, when mature glaucous, ovoid-oblong, 6-9 in. long, 4-5 in. diam.

at base. Lower part of scales 1-1½ in. long, 1-1¼ in. broad at top, upper part recurved, obtusely triangular, compressed, spinescent. Seeds cylindric, 1 in. long, with a short caducous wing.

Common in North Afghanistan and Kafiristan, abundant on the Safedkoh and probably also at high elevations on the Suliman range. In the N.W. Himalaya, locally in the inner valleys with a drier climate, beyond the influence of the periodical rains. Indus valley between Astor and Iskardo, and in Gilgit. On the Chenab, common below Kilar, on a short portion of the main river, and on the Marru, a tributary (5800-8000 ft.) A few trees occur at one place on the Ravi (at 8000-8500 ft.) In Kunawar, generally occupying the lower slopes of the mountain-sides near the river, between 6000 and 10,000 ft. (Capt. Gerard states up to 12,300 ft. near Sungnam), from Chergaon and Jani to Hangarang and Dabling. Planted at Serahn, 15 miles lower down the valley, and within the full range of the monsoon, but does not bear fruit. Also in British Garhwal, between Malari and Bampa, on the route to the Niti Pass, at 6000-10,000 ft. (Dr Jameson, 1846). Gregarious, but not forming dense forests, frequently associated with Deodar, often on dry steep rocky slopes, on granite and clay-slate in Kunawar. The male flowers appear in June and July, and the yellow pollen falls abundantly at that time, and is carried about by the wind. The cones ripen in the second year; at lower levels by the end of September, at higher elevations about the middle of October. The leaves remain 3-4 years on the branches. Attains 30-40, at times 50-60 ft., with a short straight trunk (clear of branches, to 8 or 10 ft.), girth 6-7, rarely 12 ft.; branches strong, horizontal or decurved, the ends turned up, forming a broad oval or rounded compact bushy crown. Bark grey, greenish grey, often silvery, with darker blotches, without fissures cracks or roughness, exfoliating in long thin flakes, leaving exposed patches of the fresh, smooth, darker-coloured inner bark. The peculiarly smooth bark of this species, which is never transformed into a rough outer coating like that of the other pines, was first noticed by Dr W. Hoffmeister, who accompanied Prince Waldemar of Prussia in his journey through India in 1845 and 1846.

The wood is used for the hook which supports the passenger's seat on the single-rope swing-bridge; it probably is tough, but is hardly ever felled, as the tree is valuable on account of the edible seeds. It is very resinous, and a white resin also exudes abundantly from the bark and cones. Baskets and rough water-buckets are made of the bark. The cones are plucked before they open, and are heated to make the scales expand, and to get the seed out. Large quantities of the seeds are stored for winter use; they form a staple food of the inhabitants of Kunawar, are often eaten ground and mixed with flour. It is a common saying in Kunawar, "One tree a man's life in winter." They are also exported to the plains, and considerable quantities are imported annually into North-Western India from Afghanistan by the Khaiber and Bolan Passes. They are oily, with a slight but not unpleasant turpentiny flavour. The seeds and an oil extracted from them are used in native medicine.

To the same section (*Tæda*, with 3 leaves in a sheath) as the preceding species, belong three important trees of Eastern North America: 1. *P. australis*, Michaux, the *Long-leaved* or *Yellow Pine*, also called *Pitch Pine*, a large tree, which clothes extensive dry sandy tracts, known as the Pine Barrens, along the coast of South Virginia, the two Carolinas, Georgia, and Florida. The heartwood is compact, heavy (40-53 lb. per cub. ft.), strong, durable, and much prized in America for house- and ship-building. It is very resinous, and yields the main supply of American resin and turpentine.

Michaux (Forest Trees of North America, 1819, ii. 271) gives the following description of the mode of procedure, which is confirmed by other accounts: In winter a cavity is cut into the base of the trunk about 3 or 4 inches from the ground, commonly of the capacity of 3 pints, and about 4 in. deep. These cavities are called boxes, and they have the shape of a large distended waistcoat-pocket. When the trees are large, 2 or sometimes 4 boxes are excavated on opposite sides of the trunk. Two oblique gutters are made at the edges of the box, and the surface of the stem is hacked or chipped above the box; this is repeated once a-week; the first year the chippings extend 12 in. upwards, and are carried up higher every year, but after 5 or 6 years the tree is generally abandoned. The turpentine begins to run about the middle of March, and the hottest months, July and August, are the most productive. The boxes generally fill every three weeks, and the turpentine is ladled out with wooden shovels into pails. Fires are the great danger, and on that account the ground at the foot of the trees is carefully cleared of leaves and herbage. The solid masses of resin, which concrete on the chipped part of the stem, are collected under the name of scrapings. In ordinary years it is estimated that 3000 trees, which generally form the charge of one person, yield 75 barrels of turpentine and 25 barrels of scrapings in one season, which supposes the boxes to be emptied five or six times during the season. The method of collecting resin of *P. Pinaster*, *Laricio*, and *halepensis*, in France and Corsica, described at p. 514, differs essentially from the American system, the scars being flat, and the turpentine being collected either in earthen pots, or in cavities cut in the roots or made in the sand at the foot of the tree. Large quantities of tar are made from the tops and branches and dead trees of *Pinus australis* in charcoal-kilns, which have the shape of a truncated and inverted cone; Michaux states that a kiln 10-12 ft. high, 20 ft. diam. below, and 25-30 ft. above, yields 100 barrels of tar, which seems a very large quantity. It is evident that the yellow pine is more resinous than most other Conifers. The wood of this tree is extensively used for building in the Southern States, it is also exported largely to the West Indies. The species is distinguished by long cylindrical cones, 6-10 in. long, the scales armed with short recurved spines; the leaves are 10-15 in. long.

2. *P. Tæda*, Linn., the *Loblolly Pine*, grows in the Southern States, mainly in the long narrow marshes that intersect the Pine Barrens. It also is tapped for resin, but is less valued.

3. *P. rigida*, Mill., the *Pitch Pine*, inhabits the Northern States; during last century it yielded large quantities of resin and tar, but the wholesale destruction of the trees has diminished or stopped the supply from that source.

3. **P. excelsa**, Wall. Pl. As. Rar. t. 201; Cleghorn l. c. t. 2.—Syn. *P. Peuce*, Grisebach; *P. pendula*, Griff. Vern. *Piuni*, Afg.; *Biār*, Hazara; *Chīl*, *chīr*, *chīltu*, *chītu*, *chīu*, from Kashmir to Jaunsar; *Chīla*, Garhwal; *Kail*, Bias and Sutlej (outer hills); *Līm*, *lhīm*, Chamba and Kunawar; *Yara*, *yūr*, *yiro*, Kashmir; *Shomshing*, Lahoul; *Rāisalla*, *lamshing*, *byans*, on the upper Sarda; *Tongschi*, Bhutan.

A large tree, with dark-coloured bark, divided into small irregular plates. Foliage bluish-green, or greyish-green in exceptional cases, particularly at high elevations. Leaves in clusters of 5, 6-8 in. long, slender, drooping, sheath and bracts deciduous. Cones erect while young, on peduncles 1-2 in. long or longer, pendulous when mature, cylindric, 6-10 in. long; scales closely imbricate, 2-2½ in. long, 1-1¼ in. broad, cuneate-oblong, flat, apex (apophysis) not much thickened, rhomboid, the ends rounded. Seeds ovoid, ⅓ in. long, or a little longer, with an oblong, obliquely truncate wing. Cotyledons usually 9.

Mountains of Kafiristan north of Jellalabad (Griffith), Safedkoh (Griffith and Bellew), near Rondu on the Indus below Iskardo. Himalaya between 6000 and 10,000 ft., from the Indus to Bhutan, extending considerably into the more arid tract. Lahoul, Kunawar as far as Sungnam and Namgia. Niti Pass in Garhwal. Nepal, Bhutan. Wanting in central and north-west Kamaon (Madden), and in Sikkim. The tree is occasionally found as low as 5000 and as high as 12,500 ft. *P. Peuce*, which has been identified with *P. excelsa* by Hooker (Journ. Linn. Soc. viii. 145), was first discovered by Grisebach on Mount Pelister or Peristeri near Bitolia in South Macedonia, near the borders of Albania, where it forms a considerable extent of forest at the upper limit of arborescent vegetation, above the range of the Beech, from 4400 to 5800 ft., descending to 3000 ft. (as a shrub only), and in places ascending to 6100 ft., and has since been found farther north on the Kom mountain in Montenegro. Between Macedonia and Afghanistan, a distance of 2200 miles, no trace of the tree has yet been discovered. *P. excelsa* is hardy in England, but seems inclined to seed rather early and too freely; its leading shoots are very luxuriant, but often bent and irregular. These peculiarities are noticed near Simla, wherever the tree grows below its normal line of elevation. Introduced 1823, the largest tree at Dropmore is 70 ft. high.

P. excelsa is gregarious, but does not often form pure forests of large extent. It generally is mixed with the *Deodar*, *Abies Webbiana*, and *Smithiana*, and is often found at the edges of mixed forests of leaf-bearing trees. At higher levels it grows among the Alpine Birch (*B. Bhojpattra*), and at lower levels it is not rarely found associated with *Pinus longifolia* near the upper limit of that tree. In Kunawar it forms forests of considerable extent above and below the Deodar belt, and is mixed with it. In the Baspa valley Deodar ceases at an elevation of about 9500 ft., but *P. excelsa* extends considerably higher, both at the bottom and on the sides of the valley. In the forests on the left bank of the Sutlej above the mouth of the Baspa, it often forms the main portion of the forest between the Deodar and the Alpine Birch.

It flowers from the end of April to the middle of June; in October the young cones are 1 in. long, and pea-green, in April they attain 3-4 in., and they ripen in the autumn of the second year. The seedless cones are persistent for a long time, hanging on the branches with their broad gaping scales. The leaves remain 3-4 years before they are shed. Attains 100-120, and sometimes 150 ft. in height. In isolated trees the branches are low, nearly to the ground; they are whorled, horizontal, the ends turned up, except when laden with fruit. Branches smooth, dark-grey, sometimes purplish-brown. Bark dark-coloured, cut into drab-grey rough scales, by parallel vertical fissures and cross-cracks; in old trees the scales are broad, irregularly polygonal, with whitish or silver-grey surface, divided by dark-coloured rough furrows.

Sapwood whitish, heartwood light-brown, often with reddish lines and resinous knots, compact, even-grained, soft and easy to work. As regards durability, it ranks next to Deodar, of the north-west Himalayan Conifers, and is preferred to *Abies* and to *Pinus longifolia*. In the Panjab Himalaya, it is said to last 7-8 years as shingles, 8-10 years as beams in walls, and 15 years as ordinary inside planking. Where Deodar cannot easily be obtained, it is largely used for house-building, shingles, water-channels, water-troughs, wooden spades, and other implements. It is said to be the best wood available in the Panjab for pattern-making, as it works extremely well and can be got without much resin. It yields an excellent charcoal for iron-smelting. A variety of the wood, valued less than the normal kind, is called *dar chīl* at the Ravi and Chenab timber depots. The term is not used in the forests. The wood grown on south aspects is said to be heavier and to contain more turpentine. Turpentine, resin, and tar might be readily obtained from this tree; it probably is nearly as resinous as

P. longifolia. The wood is much used for torches; *jagni*, Pushtu; *mashāl*, Hindi. Chips and small pieces of the wood form an article of trade in the treeless inner Himalaya, under the name of *Lāshi, chanshing*. The cones are useful for lighting fires. The bark is used to roof huts in the forest, and trees are often seen denuded of their bark to a considerable height. The leaves and twigs are much used for litter; and the leaves of this species, as well as of *P. longifolia*, are mixed with mortar and plaster in building. Madden states that in Kamaon, in a fair dry winter, the leaves and branches get covered with a liquid exudation, which hardens into a white kind of manna, sweet, not turpentiny, which is eaten. A similar exudation (Manne de Briançon) is collected in the French Alps on the leaves of the Larch, and used as a purgative.

P. Strobus, Linn., called *White Pine* in America, and *Weymouth Pine* in England, is similar to *P. excelsa*, but has shorter leaves and more slender cones. It is a large and most important timber-tree, formerly often found 200-250 ft. high and 18 ft. in girth, which grows luxuriantly in damp forests mixed with leaf-bearing (deciduous) trees, in the Northern United States from the headwaters of the Mississippi eastward, on the Alleghany Mountains, and in Southern Canada. The wood is white or pale-yellowish white, soft and light (30-35 lb.), free from knots, easily worked, is durable, but has little strength. It is the wood used most in North America for building, furniture, and other purposes, and is exported from Canada. The tree grows rapidly while young, is hardy in England (introduced 1705), France, and Germany, it has been cultivated on a considerable scale in some forest tracts of Germany, where the timber production per acre has been found higher than that of other Conifers.

To the same group, with 5 leaves in one sheath, belongs *P. Cembra*, Linn.; Reichenb. Ic. Fl. Germ. t. 530.—*Arve, Zirbelkiefer*, Germ.; *Cirmolo*, It.; *Ceinbrot, auvier*, Fr.; *Arolla* of the Alps. A middle-sized, slow-growing, and long-lived tree of the Alps and Carpathian Mountains in Central Europe, which forms extensive but irregular forests between 4000 and 7000 ft., often at the upper limit of arborescent vegetation. The leaves are short, stiff, dark-green, and the cones short, ovoid; the seeds are wingless, broad, ovoid, and somewhat 3-sided. They are eaten.

Of the Section *Pinaster*, with 2 leaves in each sheath, no species except the doubtful one mentioned at p. 506 inhabits North-West India. The remarkable tropical Fir of Tenasserim and Siam, which S. Kurz has identified with *P. Merkusii* of Sumatra and Borneo (Flora, 1872, 264) belongs to this section. It is closely allied to *P. sinensis*, Lambert (Benth. Fl. Hongk. 337)—Syn. *P. Massoniana*, Lamb.; of South China, Formosa and Loo Choo islands. Both species have semicylindric leaves, 7-9 in. long., the convex back marked with numerous prominent lines, and persistent sheaths; the cones are ovoid or ovoid-lanceolate, 2-3 in. long, recurved when ripe, the thickened part of the scales rhomboid. They are much alike, and may perhaps eventually be united. In the Tenasserim specimens the end of the scales (apophysis) is pyramidal, 4-7-sided, while in *P. sinensis* it is flat. The Tenasserim Pine grows in forests of *Dipterocarpus tuberculatus* of the Thoungyeen valley, which occupy vast areas of high ground and dry undulating hills, the moister valleys between being covered with Bamboo forest, often containing Teak. The wood is exceedingly resinous, the stems not very tall (50 ft. to first branch) and not very regularly shaped.

P. Thunbergii, Parlatore; DC. Prodr. xvi. ii. 388—Syn. *P. Massoniana*, Sieb. et Zuccar; Fl. Jap. t. 113, 114—is a large tree of Japan, Corea, and North China, hardy in England, with stiff rigid leaves 3-5 in. long.

The following are the more important European species of the section *Pinaster* :—

P. sylvestris, Linn., Hook. Stud. Fl. 348 ; Reichenb. Ic. Fl. Germ. t. 521.—*Scotch Fir*. *Kiefer*, *Föhre*, Germ. ; *Pin sylvestre*, Fr. A large tree with tall stem, clear of branches to a great height, bark red, foliage greyish, sometimes bluish green, crown pyramidal while the tree is young and growing vigorously upwards, rounded afterwards. Leaves glaucous, 2-4 in. long, remaining on the branches 2-3 years ; sheath short. Cones pedunculate, recurved, not shining, ovoid-lanceolate, unequal-sided, 1½-2½ in. long, ends of scales rhomboid, rugose, with a transverse keel, sometimes pyramidal and beaked. Wings 3 times the length of seeds. Central and North Europe. Also on the mountains of Spain, North Asia, Caucasus, mountains of Asia Minor and of North Persia. A variety with longer cones (3 in.), the lower scales with a thick blunt beak, leaves and twigs fragrant when bruised, is described by Andrew Murray as sub-sp. *Haynensis* (Gardeners' Chronicle, 1869, p. 473). It was raised from seed supposed to have been received from the North-West Himalaya. The tree, however, has not yet been found in India, unless it is *P. Royleana* mentioned before. It seems not impossible that some Scotch Fir cultivated in the Himalaya has been the origin of *P. Haynensis* and *Royleana*. In the northern Alps its upper limit is 5000, and in the southern 6000 ft. In the Maritime Alps inland from Mentone its range is from 1770 to 5100 ft. On the Pyrenees it grows between 3000 and 5000, and on the Sierra Nevada between 5000 and 6500 ft. Fl. May ; the cones ripen in the autumn of the second year, but often do not open until the following spring. Eminently gregarious, forms extensive natural and generally pure forests in the Highlands of Scotland, in the plains of North and East Germany, and in the Baltic provinces of Russia. Thrives best on soil which transmits water readily, particularly in sandy soil. Attains under favourable circumstances 150 ft., with clean stems 70-80 ft. long. Such dimensions are not rare in the Scotch Fir forests of Franconia, particularly in the Steigerwald, between Würzburg and Bamberg, where it is grown with an underwood of Beech. Sapwood large, enclosing a distinctly-marked reddish heartwood, durable and strong. Weight 25-46 lb. The seedlings require much light, but forests of Scotch Fir can, under favourable circumstances, be regenerated by natural reproduction. Imported into England from the Baltic and Norway, under the names of *Red Memel*, *Dantzig Fir*, and *Red Deal*.

2. *P. montana*, Mill. ; Willkomm Forstl. Flora, 169.—Syn. *P. Mughus*, Scop. *P. Pumilio*, Hænke ; *P. uncinata*, Ramond ; *P. obliqua*, Saut. ; Reichenb. Ic. Fl. Germ. t. 522, 523. *Pin à crochets*, Fr. ; *Krummholz*, *Legföhre*, *Latsche*, Germ. A slow-growing moderate-sized tree, with branches down to the base, unless growing in close masses ; crown pyramidal, not rounded or tabular when old, the lower part of the stems mostly bent down and prostrate along the ground ; bark dark-coloured, greyish-brown, never red, foliage dark green. Leaves green, rigid, 2 in. long, remaining 3-5 years on the branches, the sheaths a little longer than those of *P. sylvestris*. Cones sessile, erect or spreading, not recurved, shining, ovoid or ovoid-lanceolate, unequal-sided, 1-2½ in. long ; ends of scales rhomboid, often with a recurved beak, always with a black ring round the centre. Wings 3-4 times the length of seed. Alps and mountains of Central Europe, from the Pyrenees to Bukowina, also on the mountains of Spain and Calabria. Forms a large extent of dense but low forests on the plateaus of the Schwarzwald above 2000 ft., the stems creeping and interlacing in a remarkable manner, but always sending up erect leaders. Much of this land, wet and swampy formerly, has now been drained and planted with spruce. An important forest-tree on the Bavarian Alps between 2000 and

5000 ft. The wood is much heavier than that of the Scotch Fir, very durable, mainly used as fuel and for charcoal; but the chief value of the tree in the Alps consists in its thriving on poor soil and in exposed situations, and serving to clothe steep stony, dry and wet slopes, preventing their denudation, and affording protection against slips and avalanches. Young plants bear more shade than *P. sylvestris.*

3. *P. Laricio,* Poiret; Willkomm Forstl. Flora, 184; Reichenb. Ic. Fl. Germ. t. 524.—Syn. *P. austriaca,* Endl.; *Schwarzkiefer,* Germ. A large tree, with tall straight cylindric stem, clear of branches to a great height, foliage dark green, branchlets turned up at the ends. Leaves green, 2-5 in. long, persistent, 3-4 years on the branches, with a sharp whitish point. Cones sessile, 2-3 in. long, spreading, ovoid-lanceolate, shining, yellowish red when ripe. Seeds large, wing 3-4 times the length of seeds. Mountains of South Europe and Asia Minor, forming extensive forests in Spain, in Corsica at 3000-5000 ft., and lower Austria (Wiener Wald). Fl. May; the cones of this, as of the other allied species, ripen in autumn of the second, and shed their seed in spring of the third year. Attains 150 ft. in Corsica. Wood very resinous, sap large, heartwood red, very durable, heavier than Larch, up to 56 lb. (Mathieu). Mathieu, Fl. Forest, 398, records an instructive series of measurements of the number of rings of sap- and heartwood of the wood from Corsica. A tree 90 years old, with a radius of 235 mm., had 73 rings of sapwood, in the aggregate 185 mm. broad; and a tree of 375 years, with a radius of 380 mm., had 190 rings of sap, measuring 80 mm. and 185 rings of heartwood. The Austrian Pine is tapped for resin in Austria, and of late years the splendid forests of *P. Laricio* in Corsica have been worked on a large scale for resin, the mode of procedure being the same as in the forests of *P. Pinaster* in France. In its youth the tree has a rapid growth, and long powerful leading shoots. In England the Corsican and Austrian Pine are considered distinct varieties.

4. *P. Pinaster,* Solander; Reichenb. Ic. Fl. Germ. t. 525.—Syn. *P. maritima,* Lamarck; *Cluster Pine—Pin maritime,* Fr. A large tree, with a tall but not very straight stem attaining great girth, branches high up, forming a rounded crown; bark very thick, cut by deep fissures, foliage dense, dark green. Leaves thick, rigid, 1 line broad, 5-8 in. long, remaining 3 years on the branches. Cones purple when quite young, clustered at the end of the current year's shoots, when ripe subsessile, spreading or reflexed, in whorls and dense clusters of 5-10 or more, ovoid-cylindric, nut-brown, shining, 4-5 in. long, and 2-3 in. diam. at base, ends of scales sharply and transversely keeled, with a dark-grey conical, sharp tip. Mediterranean region, Algeria, Portugal, Spain, South and West France, Corsica, where it forms, with *Quercus Ilex,* a zone intermediate between the evergreen *Maki* of the coast and the forests of *P. Laricio.* Italy, Dalmatia. Fl. April, May; the cones ripen in autumn of the second year. Prefers a light sandy soil, and thrives luxuriantly on the white shifting sands of the Dunes along the coast of Gascogne, which, by means of sowings steadily continued ever since 1789, have now been converted almost entirely into forests of this tree. It also forms extensive nearly pure forests, to a great extent planted, on the heaths of the "Landes."

The wood has numerous large resinous ducts, and the tapping of the tree is carried on in a methodical manner in Gascogne, which should be imitated in India if it be resolved to work any of the Himalayan Pines systematically for resin. When the tree has attained a girth of 3-4 ft., a flat cut is made near the ground through the bark into the wood, a few inches high, and about 5 inches wide; the resin which exudes is collected in small earthen pots, fixed at the base of the cut, into which it runs over a flat piece of zinc. From time to time, once or twice a-week during the season (1st March-15th Oct.), the cuts are extended upwards, and this is continued until the flat scar or cut (*carre*) is 10-12 ft. high. This is generally accomplished at the end of 5 years, and then the old scar is abandoned, and a fresh scar is opened at the opposite side of the tree, and when this has been completed, a third and at last a fourth scar are opened. In this manner a tree can be worked for resin during a considerable period, the old scars healing over by the formation of fresh bark, while fresh scars are opened, often on the place of an old scar. This procedure, when only one scar at a time is worked, is called "*gemmage à vie.*" But when a tree is to be cut, then numerous scars are opened and worked simultaneously, and this is styled "*gemmage à mort.*" In the same manner, when young trees are to be thinned out, they are tapped at a much earlier age, and as much resin got out of them as possible. As the scars advance in height the pots are raised also, and in order to get up to them the workmen carry a short pole with notches, which serves as a ladder. Fire in summer is the great risk in forests worked for resin, and in order to prevent its spread, broad fire-paths are cleared throughout the forests. *P. Pinaster* has been cultivated on a considerable scale in the sand-dunes near Boulogne; it was introduced into England as early as 1596, and there are splendid specimens in Windsor Park (Belvidere), Fulham, and elsewhere. An attempt has also been made to plant it on the sands of the Madras coast, but a tropical climate is not apparently adapted to the requirements of this tree. The tree grows with great rapidity while young, and in South-West France often forms two whorls of branches in one season. It has powerful descending and spreading roots, and is thus peculiarly adapted for fixing loose movable sands.

5. *P. halepensis*, Mill.; Christ in Flora, 1863, p. 370; Lambert, Pinus, ed. 1832, t. 7; Reichenb. Ic. Fl. Germ. t. 526.—Syn. (the Greek tree) *P. maritima*, Lamb. l. c. t. 6; Sibthorp Fl. Græca, t. 949. *Pin d'Alep*, Fr. A moderate-sized tree, sometimes shrubby, with light foliage, of a light-green or bluish-green colour, and a rounded crown. Bark on branches and young stems smooth, shining, silver grey, on older stems dark coloured, furrowed. Leaves slender, 2-4 in. long, grey or bluish green, remaining two, often only little more than one year on the branches, hence the thin foliage; sheaths ¼ in. long, whitish, membranous. Cones on peduncles ½ in. long, recurved, solitary or 2-3 together, lanceolate, 2-4 in. long, reddish brown, and mostly shining when mature, the ends of scales rhomboid, flat or convex, with or without a distinct transverse keel. Mediterranean region, from Portugal and North Africa to Syria and Arabia. Taurus in Asia Minor, where it forms extensive pure forests. Ascends in Spain to 3000, and on the Taurus to 3500 ft. Fl. April, May; the cones require two years to ripen, and do not shed their seeds until July and Aug. of the third year. Hardy in the south of England. Might be tried in the plains of the Panjab. In Provence, where this pine is common in the vicinity of the sea, it is tapped for resin, but is less productive than *P. Pinaster*. In Greece the tree (πεῦκος, modern Greek) is abundant, forming extensive but irregular and open forests on the stony and rocky hills of Attica, Megara, around the Gulf of Lepanto, on the islands of the Archipelago, and in the Morea, ascending to 3000 ft. on Hymettus and Pentelicus. The wood is used for building, and the tree is largely tapped for resin; pieces of the resinous wood are used as torches, and the bark is employed for tanning. Link, after having seen the Greek tree in Attica, in 1838, maintained it under the name of *P. maritima*, Lamb., as distinct from *P. halepensis*, distinguishing it mainly by the (light) green colour of the foliage, which is generally more grey or glaucous in the tree of Italy and France (Linnæa, xv. (1841) 495). He added, however, that these 2 species were difficult to distinguish. Christ (Flora, 1863, 371) shows that the forms from Greece, Italy, and France vary exceedingly in the end of the scales (apophysis), and equally so in the other characters, and that no fixed distinction

can be maintained between the two species. Grisebach, however, retains *P. maritima*, Lamb., as a distinct species, peculiar to the evergreen region of the eastern Mediterranean, distinguishing *P. halepensis* by shorter leaves and the ends of the scales transversely keeled (Flora, 1861, 597, and Vegetation d. Erde, i. 315).

P. pyrenaica, Lapeyr.; DC. Prodr. xvi. 384.—Syn. *P. Brutia*, Tenore Fl. Neap. t. 200, is a large tree, forming extensive forests in the mountains of Central Spain, and on the south face of the Pyrenees (2000-3000 ft.), also found in Calabria (2400-3600 ft.), Crete, Cyprus, the Taurus of Cilicia, and in Syria and Bithynia, with subsessile spreading cones 2-3 in. long, conical, with a flat base, and in dense clusters of 3-15 or more, ends of scales almost flat; leaves 4-8 in. long, dark green, narrow, lax, not rigid.

6. *P. Pinea*, Linn.; Reichenb. Ic. Fl. Germ. t. 428, 429. *The Stone Pine. Pignon*, Fr.; *Pigno*, It.; *Pinie*, Germ. A large tree with a tall not very straight stem, clear of branches to a great height, and bearing a flat umbrella-shaped crown. Leaves 3-6 in. long, rigid, with a sharp point, remaining 3 years on the branches, narrower than those of *P. Pinaster*. Cones large, ovoid or subglobose, 4-6 in. long, smooth, shining, the ends of scales convex-pyramidal with 4-6 rounded faces, seeds ¾ in. long, without wings, edible, forming an important article of trade. Throughout the Mediterranean region, chiefly in the vicinity of the coast, and often in forests of large extent. The celebrated Stone Pine forest "Pineta," near Ravenna, stretches for a distance of 20 miles along the coast of the Adriatic. Stone Pine forests are in Tuscany, Portugal, Andalusia, on Mount Athos in Macedonia, and in Asia Minor. The original home of the Stone Pine is probably the eastern Mediterranean region. The tree is hardy in the south of England, and its cultivation might be tried in the sub-Himalayan tract of the Panjab. Fl. April, May; the cones take 3 years to ripen.

2. CEDRUS, Link.

Evergreen monoicous trees. Leaves needle-shaped, single on elongated shoots and on the first shoots of seedlings, otherwise in dense fascicles on short arrested branchlets. Catkins single, cylindric at the ends of the leaf-bearing branchlets. Anther-cells 2, dehiscing longitudinally, adnate to the under side of imbricate scales, which are prolonged into flat ovate-oblong, obtuse, denticulate crests. Ovules inverted, in pairs at the base of the carpellary scales, these in the axils of small bracts, which disappear before the fruit ripens. Cones ripening the second year, lateral, erect, formed of broad obtuse carpellary scales, with a thin edge and a thickened woody base. Seeds oily, with a hard woody testa, and broad membranous wings.

1. **C. Deodara**, Loudon; Cleghorn l. c. t. 1.—Syn. *Pinus Deodara*, Roxb. Fl. Ind. iii. 651. *Deodar, Himalayan Cedar*. Sans. *Devadāru* (the divine tree). Vern. *Nakhtar, lmanza*, Afg.; *Diār, dewdar, deodār, dedwar, dadār*, Hazara, Kashmir, Garhwal, and Kamaon; *Palūdar*, Hazara; *Kelu, keoli, kilar, kilei*, Chenab to Jumna; *Kelmang*, Kunawar; *Giam*, Tibet.

A large tree with dark-coloured bark, the extremities of branchlets drooping while young. Foliage (in North-West India) dark green, lighter, sometimes bluish green in young trees. Leaves 1-1½ in. long, rigid, sharp, triquetrous, the leaves of 3-5 years on the branches. Cones erect, 4-5 in. long and 3-4 in. diam., ovoid or ovoid-cylindrical, obtuse, scales closely imbricate, broadly cuneate, 2-2½ in. broad and 1-1½ in. long, the upper edge rounded. Seeds ½ in. long, wings large, triangular, with rounded sides.

The Deodar, so far as known at present, has a limited range of distribution. It is indigenous on the mountains of Afghanistan and North Beluchistan, and in the North-West Himalaya, where its eastern limit is below the Niti Pass on the Dauli river, one of the main feeders of the Alaknanda. No indigenous forests of it are known east of 80° or west of 66° long. On the Safedkoh it grows between 6000 and 10,000 ft., and in the Himalaya generally between 4000 and 10,000 ft., but descends in places to 3500 and ascends to 12,000 ft. The tree is commonly planted in Kamaon near villages and in temple-groves, and here and there in Nepal. It is gregarious and forms extensive forests in the basin of the main tributaries of the Indus, on the Tonse, Jumna, and Bhagirati rivers, and on two feeders of the Alaknanda. In these forests the Deodar alone covers large areas, or is associated with *Pinus excelsa* and *Abies Smithiana*, less commonly with *Abies Webbiana*, and the three Oaks, *Quercus incana, dilatata*, and *semecarpifolia*. The *Cypress, Birch, Taxus*, and in Kunawar and Pangi *Pinus Gerardiana*, are also companions of the Deodar. It extends to the limits of the arid zone, but does not enter it as *Pinus excelsa*. On the Chenab it ceases at Galing above Triloknath, and in the Sutlej valley the upper limit is the Hangarang Pass on the right and Dabling on the left side, and on the Baspa it ceases below Rakcham. In these valleys and on the Indus *P. excelsa* grows much higher up. It is wanting in Lahoul. The Deodar was introduced into England in 1822, and is hardy in England and Scotland, also in South Europe, France, and South-West Germany. On the Rhine at Coblenz, Bonn, and Cologne it suffers from late spring frosts. On the other hand, at Tharant in Saxony, where the winter is more severe, the Deodar seems to do well. In the Himalaya it is found on gneiss, granite, and silicious shales, and is not wanting on limestone (Jaunsar, Chenab).

The male catkins appear in September, and shed their yellow pollen in October, which is blown about in abundant profusion. In the ensuing spring the young cones are about 1 in. long; in October, twelve months after flowering they have attained half size, and ripen in October or November of the second year, thus requiring 24-26 months to come to maturity. The scales and seeds fall, and in November and December the persistent scaleless axis of the cones is often seen on the same tree with the half-formed cones of the preceding year and the female catkins recently fertilised. The Deodar seeds freely and regularly, but every third or fourth year the cones are apt to fail. In April a flush of young leaves comes out at the ends of the tuft-like branchlets, of a light, often bluish-green colour, forming a striking contrast with the older darker green foliage of the previous years. Owing to the close proximity of the leaves of successive years on the stunted branchlets, it is not easy to say how many years they persist, 3-5 years seems to be the average. The foliage of young Deodars grown in Europe is generally bluish green; in the Himalaya this colour is seen occasionally, but as a rule the foliage, save the youngest shoots of spring, is green and rather dark. Young Deodar requires shelter and bears a good deal of shade; the terminal shoots, like the extremities of the branches, are soft and drooping, nevertheless, they pierce with great vigour through thickets of other trees, and it is not a rare occurrence to see the proportion of Deodar in an Oak forest increase by self-sown seedlings, which come up under the shelter of the Oak and make their way through its foliage. In compact forests the tree clears itself early of its side branches, and forms tall clean straight cylindrical stems, which carry their girth well up to a great height. The tallest Deodar which I have measured was in the Nachar forest on the Sutlej (Oct. 1864), 250 ft. high, 20 ft. in girth at the base, and more than 550 years old, and there was a considerable number of trees in the same forest above 200 ft. high. This, however, was an exceptional case; the forest had grown up close together on terraces of fields deserted centuries ago, and the trees had found ample nourishment in the deep and loose soil of these terraces, the old walls of which were still standing (Bussahir Forest Report, 1865, 3).

In this place, as under similar circumstances elsewhere, the Deodar carries its girth well up, as illustrated by the following measurements of the girth of five trees in Nachar, at the base of the stem, at 40 and at 80 ft.:—

	AT BASE.		AT 40 FEET.		AT 80 FEET.		
	ft.	in.	ft.	in.	ft.	in.	
1.	9	10	7	6	6	6	5′ 11″ at 94 ft.
2.	9	7	7	11	4	6	
3.	10	9	8	7	7	6	
4.	15	10	11	2	10	2	8′ 7″ at 122 ft.
5.	14	7	12	7	11	0	7′ 1″ at 150 ft.

Taking the girth at base at 100 in. and the sectional area at 100 sq. in., the girth and sectional area (square of quarter girth) would on an average be as follows, at heights of 40 and 80 ft.:—

Average girth,	100 in.	78 in.	65 in.
Av. sec. area calculated by sq. of qr. girth.	100 sq. in.	60 sq. in.	42 sq. in.

When isolated, the tree has in its youth a pyramidal crown with branches close to the ground. At a certain age, which varies according to locality and circumstances, the Deodar loses its leading shoot, the uppermost branches spread out and form a flat tabular top. Trees which grow isolated on the crest of ridges or otherwise in exposed positions, have these flat tabular tops in a very marked manner. Isolated trees attain large girths, the largest on record, in Kunawar, are 30-36 ft.; and Dr Stewart measured one at Kūarsi in the Ravi basin, at 7500 ft. elevation, 44 ft. 2 in. at 2, and 36 ft. 4 in. at 6 ft. from the ground. A tree measured in October 1864 above the village of Purbani in Kunawar, was 34 ft. 4 in. in girth, and judging by the annual rings of trees felled in that neighbourhood, probably about 900 years old.

The bark is 1-1½ in. thick, dark grey, often blackish with a brown or purple tinge, cut by long vertical dark furrows and short transverse cracks into long irregularly truncate scales. The wood of mature Deodar, unless very old, is generally sound throughout, but there are exceptions. Thus in the following blocks of the Bhagirati forests the proportion of unsound first-class trees was found to be as follows:—

Hirsil,	sound	920,	unsound	736.
Tailgari,	„	1179,	„	589.
Dinargad,	„	35,178,	„	22,386.

(Colonel Pearson's Report on the Bhagirati Forests, 1869.)

It has not been ascertained whether this unsoundness should be attributed to the practice of burning the forest for temporary cultivation or to other causes. The sapwood is whitish and not durable, in mature trees it is 1½-3 in. thick, the heartwood has a fine light-brown colour, is fragrant and somewhat oily, compact, even-grained, does not readily warp or split, and is exceedingly durable. The timber from the Jhelam forests is reckoned the best; it is very oily and darker coloured. The weight of seasoned Deodar varies between 25 and 44 lb. In the Panjab it is generally supposed to weigh 40 lb. The transverse strength is less than that of *P. longifolia*, so far as recorded experiments go. The values of P. are as follows: I. Panjab timber, nine experiments made at Rurki—549 to 669; ten experiments by Major Robertson and Captain Henderson—461 to 649; thirty-three experiments by Cunningham—189 to 858; average of Panjab timber, 575. II. Garhwal timber, eight experiments made at Rurki—390 to 798; average, 592. III. Kamaon timber, twenty experiments made by Captain Wm. Jones, and recorded by Madden in Journ. Agric. Soc. of India, vii. 1850, at Almora in Oct. 1844—viz., ten with timber cut Sept. 1844, weight 38 lb., value of P. 443, and ten with seasoned timber, weight 40 lb., value of P. 560. In this case, as in the experiments with *P. longifolia* noted above, it is remarkable that the average weight of seasoned timber is about the same as of that cut a month previous. It should, however, be mentioned, that the Almora experiments do not give *P. longifolia* a much greater transverse strength than Deodar; and it has been stated, but probably on insufficient grounds, that the transverse strength of Deodar is greater than that of either *Pinus longifolia, Pinus excelsa,* or *Abies Smithiana.* A larger series of systematic experiments to determine the physical and mechanical qualities of the timber of the more important Himalayan Conifers is much wanted. The sapwood commences to decay while the logs are seasoning in the forest, much of it is knocked off on the slides by which the timber is sent down to the water's edge, and during the long water transit to the plains, while the logs are rubbing and bumping against the numerous rocks in the rivers. The heartwood is by far the most durable of the Himalayan timbers of this tribe (*Abietineæ*), and in the climate of Kashmir and the Panjab it is almost imperishable. Stewart states (Panjab Pl. 220) that the Deodar pillars of the great Shah Hamaden mosque in the capital of Kashmir are probably more than 400 years old (the date, 804 Hijra, 1426 A.D., is entered in an inscription over the door), and that to all appearance they are perfectly sound. Some of the bridges in Srinagar are said to be of still greater antiquity; the wood of which the piers are constructed is Deodar, and part of it is alternately wet and dry. These piers, it is believed, have never been renewed since the bridges were built. White ants eat the sap, but rarely attack the heart-wood. The boats built of it on the Panjab rivers are said to last forty years. Owing to these excellent qualities, combined with lightness, Deodar has from time immemorial been the wood most prized in the Panjab and Sindh, and the timber-trade on the five rivers and their feeders is of very old date. The consumption of the wood, however, has, like that of most of our more valuable Indian woods (Teak, Sissoo, Sāl, Blackwood), increased largely and rapidly since the British occupation of the country. Barracks and other public buildings, bridges, canals, and mainly the construction of railways, have created a large and pressing demand, the first effect of which has been the destruction, beyond hope of recovery, of numerous and extensive forests formerly stocked with fine Deodar. Not only were the forests cut down wholesale without any regard to their regeneration, but of the timber felled a small proportion only was utilised, the greater part being destroyed by the forest-fires, or broken to splinters on their way to the river over precipices and rough slides, and another portion being jammed up in numerous narrow rocky passages in the river, or caught and abstracted by the people living near the banks. This state of things was first prominently brought to notice by Dr Cleghorn, who was deputed in 1861 to report on the timber resources of the Panjab; and thorough and vigorous action to remedy these evils was taken by the late Dr Stewart, who in 1864 was appointed the first Conservator of Forests in the Panjab.

During the first 3-4 years of its life Deodar grows slowly, attaining 12-20 in. in height, with spreading roots, which do not go deep down. In this shrubby and stunted state the young plant can maintain its existence under the shade of other trees for a considerable number of years without making much progress, but when light overhead is given, then a leader is at once formed, which shoots up rapidly. At a more advanced age the rate of growth of the Deodar is determined without difficulty by counting the annual rings: they are well-marked, and as vegetation rests completely in winter at the elevation where the tree grows, there is no reason to doubt that each concentric ring indicates one year's growth, in the same manner as is the case in the coniferous trees of Europe. It has been asserted that the *Wellingtonia gigantea*, and several other coniferous trees, form two rings a year. There is no ground to suppose that this is the case in the Deodar or in any of the other Himalayan Conifers; and we have from the commencement employed the same methods for ascertaining the fundamental facts upon which the plan for working these forests must be based, which are used for regulating the management of coniferous forests in France and Germany. The data available show clearly that the rate of growth of the Deodar is much influenced by the greater or less moisture of the climate. Thus, in the forests at the head-waters of the Bhagirati river, in a dry climate, the tree requires upwards of 200 years to attain a girth of 6 ft.; whereas in the Jaunsar forests, in the outer hills, with a heavy rainfall, 70 years suffice to attain this size. The present estimate is, that in the upper Bhagirati forests it takes a Deodar on an average 86 years to increase in girth from 4 ft. 6 in. to 6 ft., and that in Jaunsar this is accomplished in 23 years. In the upper Kunawar forests, in a dry climate, where vineyards occupy the lower slopes of the valley, and where *Pinus Gerardiana* and *Quercus Ilex* are associated with the Deodar, the age of a tree 6 ft. in girth is 140 years or more; while in the outer hills, in the vicinity of Simla, with an annual rainfall of 50-80 in., it is usual to find that trees 70-100 years old have attained that size. Again, the Deodar timber floated down the Cabul and Swat rivers to Peshawar, which is produced in the comparatively dry climate of Afghanistan, shows a slow rate of growth—logs from the Cabul river having at the butt end, for a girth of 6 ft., on an average 214, and timber from the Swat river 156 rings. In the case of the Cabul timber the lower temperature has, probably in addition to the dry climate, a considerable influence in retarding the rate of growth. Besides climate, there are other elements which influence the rate of growth of Deodar, as well as of other trees in mountainous countries. Foremost stands elevation, in the second place the greater or less steepness of the slope, and the nature of the soil. Again, trees which have grown up in a crowded state lay on wood more slowly, and have necessarily narrower rings, than trees which have stood more isolated and bear a fuller head of branches. Of these elements several are often found combined, and it is not therefore in all cases easy to determine the influence of each separately. The rate of growth of Deodar in the Bussahir and neighbouring forests was studied with special care in autumn 1864, with the view of determining the data which should form the basis of a preliminary plan for working these forests, and the results are recorded in the official Report already quoted. Additional data have since been collected in other forest districts. At page 9 of that Report an abstract statement is given, exhibiting the results of the examination in detail of the annual rings near the base of 380 trees, classified in three great divisions—forests with slow, average, and rapid rate of growth. As explained before, the forest tracts classed under the first division (age of trees 6 ft. in girth above 140 years) are mostly situated in a dry climate in the vicinity of the arid zone of the inner Himalaya; those classed under the third division (age of trees 6 ft. girth below 110 years) are mostly in the outer ranges under the full influence of the monsoon; and those with an intermediate rate of growth are chiefly situated in the intermediate ranges and valleys. There are, however, several noteworthy exceptions, showing that various circumstances besides moisture influence the rate of growth of the Deodar. Thus, in the Phinla, Kiuden, and Kilba forests, 138-154 years were found as the average age of a tree 6 ft. in girth—a slow rate, although these forests are situated in the lower, that is, moister portion of Kunawar. The high elevation of these forests (8000-10,000 ft.) explains this apparent anomaly. Again, Col. Pearson records an average of five rings to an inch of radius in the Bodia forest of Jaunsar at an elevation of probably 6000 ft., and eight rings in the Tutwa forest, north of the Karama Peak, several thousand feet higher. Another exception is the Nachar forest, at the bend of the Sutlej valley, at about 7000 ft. elevation, under the influence of a heavy monsoon, on level ground with deep and rich soil, as mentioned above. Yet the growth of 30 trees examined gave an average of 149 rings for a girth of 6 ft. Here the trees had grown up close together, hence the unusually tall stems and slow growth. To a certain extent this circumstance may have contributed to keep down the rate of growth in the Phinla and Kilba forests. The influence of the gradient was exemplified by a number of trees examined in the Serinche forest, on the Baspa river above Sangla. Here 10 trees, which had grown on level ground, attained a girth of 6 ft. in 62 years on an average; and 4 trees on a slope of 30 degrees had required 132 years to accomplish this,—the extremes being, in the first case, 36 and 83, and in the second case 102 and 173 years.

Regarding the crop of timber per acre in a mature Deodar forest, our information is scanty. The large mass of the natural pure Deodar forests is imperfectly stocked; most of those from which the timber could readily be sent down to the river are nearly exhausted, so that the opportunities for examining fully-stocked tracts have not been numerous. The following data are recorded in the Report quoted above :—

			AREA SURVEYED. Acres.	AGE OF FOREST. Years.	TREES PER ACRE.	CROP PER ACRE. Cub. ft.
1.	Jaunsar,	Mayshak forest, . .	0·69	70	54	2464
2.	"	above Khattowa village,	0.46	84	69	3604
3.	"	Chilara forest, . .	0.34	88	70	4328
4.	Kunawar,	Kiuden forest, . .	1.60	180	56	5512
5.	"	" . .	0.33	180	90	8972
6.	"	Nachar forest, . .	2.30	250	62	12,300

Cub. contents calculated by square of quarter girth.

This includes, not the tops and branches, but only that portion of the stem which, under existing circumstances, yields marketable timber. In the Nachar forest, the available length was taken at 80 ft., and in the other forests at 50-60 for first-class (above 6 ft. girth), and at 25-30 for second-class trees (4-6 in. to 6 ft. girth). That portion of the Nachar forest in which this survey was made, contained (before felling operations commenced) per acre 54 first-class trees, yielding 218 cub. ft., and 8 second-class, containing 66 cub. ft. each. The other forest tracts contained between 54 and 90 trees of the two first classes—that is, exceeding 4 ft. 6 in. in girth. By way of comparison it may be stated that, in North Germany, forest tracts of limited extent, exceptionally well stocked, and older than 120 years, have been found to yield the following crop :—

Scotch fir 85-95 ft. high, 565 cub. metre per hectare, 8,074 cub. ft. per acre.
Beech above 95 ft. „ 600 „ „ 8,574 „
Spruce 95-130 ft. „ 760 „ „ 10,860 „

Cub. contents calculated by exact measurement, not by squares of the quarter girth.

Some of the mixed forests of spruce and silver fir in the Schwarzwald, 150-170 ft. high, contain more, probably about 12,000 or 13,000 cub. ft. per acre. In mature forests of average quality the crop is between one-half and three-fourths of these figures. These quantities do not include tops and branches, but they include all wood above 7 centimetre diam., or 8¾ in. in girth, and they are calculated by exact measurement; whereas in calculating the data relating to Deodar, that part of the tree only was taken into account which was supposed to be marketable at the time the surveys were made, and consequently nothing under 3 ft. girth was included, and the calculation was made by the square of the quarter girth. In the Nachar forest, moreover, the length of available timber was arbitrarily assumed at 80 ft.; because, though the average height of the trees was 150-200 ft., yet, on account of breakages, a greater length was not as a rule supposed to be utilised (Bussahir Forest Report, p. 24). If in the Nachar forest the entire length of stem down to 9 in. girth had been taken, and the calculation made by exact measurement, the result would probably have been 18,000 cub. ft. per acre. These, however, were exceptional cases of compact and pure Deodar forests of limited extent. Excluding such exceptional cases, there seems no ground to expect that regular Deodar forests will yield timber crops heavier than those of the Spruce and Silver Fir in Central Europe. The great mass of Deodar-producing tracts in the N.W. Himalaya is very poorly stocked with mature timber. The result of 20 surveys made by me in June 1863 in the different parts of the Jaunsar forests on an aggregate area of 485 acres, gave 1195 first- and 1662 second-class, or a total of 2857 Deodar trees above 4 ft. 6 in. girth, amounting to nearly 6 trees per acre of both classes; and 82 surveys made in the Bussahir forests in October 1864, in conjunction with Capt. E. Wood and the late Dr Stewart, gave 3743 Deodar trees of the first and 4099 of the second class—total, 7842 trees of both classes, amounting to 12 trees above 4 ft. 6 in. girth per acre. The survey of the Bhagirati forests, which was made in 1869 under the direction of Colonel Pearson, gave a total of 116,700 first- and 53,660 second-class trees on 11,500 acres, or about 15 trees above 4 ft. 6 in. girth per acre on an average. The second-class trees in this case were fewer than those of the first; as a rule, most surveys in forests already worked have hitherto shown an excess of second over first class trees. A great portion of the Bhagirati forests, however, had never been worked when the survey was made; but many of those I surveyed in Bussahir had been much impoverished by felling, and in the majority Deodar was not the only tree, but was associated in varying proportions with *Pinus excelsa*, *Abies Smithiana*, and a few other trees.

The great demand for Deodar wood has naturally called forth estimates of the total quantity of mature timber available for the requirements of the present generation. The foregoing remarks regarding the irregular character of these forests will explain that these estimates could not be made from areas stocked with Deodar, but the only way in which a result could be obtained was to make approximate estimates of the number of trees available. In December 1868, the late Dr Stewart estimated the number of first-class Deodar trees in the Kashmir forests, which could be made available for the market without great trouble and expense, at 117,000 trees, and he thought that the Panjab forests in British territory, and those leased from the Rajahs of Chumba and Bussahir, might probably yield the same quantity. The Jaunsar forests on the Deoban ridge, between the Tonse and Jumna river, were estimated by Colonel Pearson in May 1869 to contain 34,000 available first-class trees, and the Bhagirati forests (not including the Nilang valley), as mentioned above, 116,700 first-class trees. If to these are added the probable contents of the available forests on the head-waters of the Tonse and Jumna rivers, the total number of first-class Deodar trees which were considered readily available for the market in 1868 and 1869 did not at that time exceed 500,000. Regarding this estimate, it should be borne in mind that most of the northern forests, from the Jhelam to the Sutlej, had been worked excessively during the last 25 or 30 years, and that in the Panjab those localities only were included in the estimate which were situated on slopes immediately overhanging the river or its main tributaries, whereas a large portion of the south-eastern forests on the feeders of the Jumna and the Ganges rivers were intact, and that here forests situated at a distance from the main river were included in the estimate. In addition to the quantity mentioned, there are extensive forests containing Deodar in side valleys, on small tributaries, and in places difficult to work, which it is hoped may be found to contain twice or three times the quantity estimated to stand in the vicinity of the main rivers. Nevertheless it is evident from these data that the quantity of Deodar growing in the N.W. Himalaya is limited. The natural regeneration of this valuable tree by self-sown seedlings is good when the climate is moist, the soil ample, and the slopes not too steep, save where a complete clearance has been made, for then herbs, brambles, and brushwood occupy the ground and prevent the growth of seedlings. And this is noticed equally where the clearance has been effected by felling and where the forest has been cut down by avalanches. Deodar requires shelter while young, and does not come up without it. Most forests, however, contain a large proportion of young trees. In the Bhagirati forest (area 11,500 acres), excluding the Nilang, the number of trees of the different classes was reported as follows:—

First class above 6 ft. in girth, . . .	116,700	trees.
Second class 4 ft. 6 in. to 6 ft. girth, . .	53,660	„
Third class 1 ft. 6 in. to 4 ft. 6 in girth, . .	127,536	„
Fourth class below 1 ft. 6 in girth, . .	213,281	„

and the proportion is similar in other forests. Speaking broadly, the trees which now belong to the two first classes must be made to last until a sufficient number of the younger classes and planted Deodar shall have attained a marketable size —that is, for a period which will be found to vary in the different forest tracts between 50 and 100 years.

As compared with other Conifers of the tribe of *Abietineæ*, Deodar has a great power of reproduction, and its branches often show a tendency to form straight leading shoots. In many parts, particularly in the outer ranges, the tree near villages is lopped of its branches to a considerable height. The naked stem reclothes itself with side branches in a short time. Trees are often found with the main stems, instead of running up straight, dividing into numerous branches, each forming a separate leader. This division sometimes takes place near the ground, sometimes at a height of 10 ft. or more. These leaders form tall and well-shaped tops, so that at a distance the forest has a deceptive appearance. The trees appear to be tall and well formed, whereas on approach they are found to be worthless for timber, being only the candelabrum-like branches of a short stem. Forked stems also are not rare, with two parallel leaders instead of one; and when young trees grow up isolated, with branches down to the ground, it sometimes happens that one of the lower branches sends up a straight leader at some distance from the stem. This tendency to form secondary leaders sometimes shows itself in Deodar planted in England; in the Himalaya it is particularly marked where the main leader has been cut or mutilated, or crushed by snow, or where avalanches have passed through the forest. In the vicinity of villages, and particularly near the edge of the arid and treeless tract, the Deodar is much cut to furnish material for building and fencing; and in places, *e.g.*, in upper Kunawar, it is customary to cut the upper part of the stem only (the top of the tree answering the purpose with less labour), upon which the side branches left on the stem lower down repair the damage by taking the lead and forming straight ascending secondary stems. The Deodar has so great a power of reproduction that if only a small branch is left on the stump of a felled tree, numerous shoots grow up, which almost have the appearance of coppice-shoots. Unlike most other trees, the trees of the Pine tribe do not coppice from a leafless stump; but so great is the power of reproduction in the case of the Deodar that the appearance is often deceptive, and indeed it has, though I believe without sufficient data, been asserted that Deodar coppices like Oak, Teak, and other leaf-bearing trees (Laubhölzer, Bois feuillus).

C. Libani, Barr.—Syn. *Pinus Cedrus*, Linn., and *C. atlantica*, Manetti—the *Lebanon* and *Atlas Cedars*—are so closely allied to the Deodar that it is not possible to separate them by constant specific characters. This has been clearly proved in Dr Hooker's important paper in the Natural History Review, 1862, 11, on the Cedars of Lebanon, Taurus, Algeria, and India. Both have shorter leaves than the Deodar, and the extremities of the branches are stiff and not drooping. Under cultivation in England the three Cedars show each a peculiar habit of growth, the Atlas Cedar being particularly distinguished by a stiff erect rigid leader, and stiff spreading branches with short leaves. The foliage of the Lebanon and Atlas Cedar is generally dark, that of the Deodar is often light or bluish green, but there is a silvery variety both of the Atlas and Lebanon Cedar, and, as mentioned above, Deodars with bluish foliage are not wanting, though rare, in the N.W. Himalaya. Old trees of all three kinds when growing isolated, particularly in exposed situations, are apt to form tabulated tops; and, on the other hand, where the Lebanon Cedar grows up crowded in groups or compact masses, it forms tall and erect stems, like the Deodar in the Himalaya. The male catkins, the cones, and seeds furnish no difference of importance. At Kew the Deodar is the first to come out with a flush of young leaves, the Lebanon Cedar follows a fortnight later, and the Atlas Cedar comes last, after another interval of a few days. The early commencement of the vegetation in the case of the Deodar explains its being less hardy on the continent of Europe than the Lebanon Cedar, which thrives well and attains a considerable size all along the Rhine from Basle to Cologne. In central France young trees often suffer from frost (Mathieu, Fl. For. 379). On their native mountains all three Cedars have a distinctly marked heartwood, which is brown, close-grained, and aromatic; but the wood of trees planted in Western Europe has a pale-reddish colour, is light, spongy, soft, and slightly aromatic. The wood of the Lebanon Cedar grown in England weighs 30 lb., and Mathieu quotes 29 lb. as the weight of wood grown at Nancy (age 19 years, diam. 11 in.), while a piece of wood from the Atlas (age 88 years, diam. 7 in.) weighed 48 lb.

In Western Europe the Lebanon Cedar has an extremely rapid growth. Mathieu cites one, 125 years old, and 23 ft. girth at 6 ft. from the ground (Fl. For. 381). Of the numerous instances of rapidly-grown Cedars in England, it will suffice to quote a group at Bayfordbury, Herts, mentioned by Selby (British Forest Trees, 539), of 12 or 14 trees, 90 years old, and measuring 10-14 ft. in girth near the base. The Atlas Cedar grows on the higher mountains of Algeria, where it forms extensive forests at an elevation between 4000 and 7000 ft. The Lebanon Cedar is found in Asia Minor on the Anti-Taurus (lat. 40°) between 3900 and 4200 ft., and, farther south, on the Taurus mountains, where it forms (with *Pinus Laricio*) the upper forest region between 4000 and 6400 ft. up to the limit of arborescent vegetation. It also occurs in the northern part of the Lebanon chain, where Ehrenberg found it in forests of Oak; and the last outpost is that remarkable grove of about 400 trees, at the head of the Kedisha valley (lat. 34° 14'), which has been mentioned by many travellers, and which Hooker has well described in the paper quoted above. The grove measures about 400 yards in diameter, it stands in a broad shallow valley, drained by a feeder of the Kedisha, which runs to the Mediterranean, at an elevation of about 6500 ft.

above the sea, which, as the crow flies, is only 18 miles distant, and 3500 ft. below the highest point of the Lebanon, which is about 3 to 4 miles farther north. The trees stand in nine groups on the broken ground of an ancient moraine, the relic of a colder period when the Lebanon was covered with perpetual snow, and sent its glaciers down into this valley. The largest tree is 40 ft. in girth, but 8 trees only measure above 20 ft., and the smallest have a girth of 18 inches. The growth, as might be expected at that elevation, has evidently been slow; no young growth is coming up. At present this grove does not recruit itself by self-sown seedlings, which are all destroyed by goats, but appears destined to diminish slowly by the death and destruction of the old trees.

It is a remarkable fact that the natural habitat of the *Deodar*, *Pinus excelsa*, and several other coniferous trees, is limited to high elevations on large mountain-ranges, that they are nowhere found indigenous in the plains, and that their area of distribution is interrupted by great distances.

3. ABIES, Tournef.

Evergreen monoicous trees. Leaves single, not tufted, needle-shaped, or narrow linear. Branches whorled and scattered. Male catkins single, cylindric, in the axils of leaves; anther-cells 2, dehiscing longitudinally, transversely, or in an irregular manner, adnate to stipitate scales. Ovules inverted, in pairs at the base of the carpellary scales, which are in the axils of membranous or coriaceous bracts. Cones ripening the same year, terminal or lateral, hanging or erect, formed of numerous, obtuse, imbricate, carpellary scales, with a thin edge and a woody base, deciduous or persistent. Seeds oily, winged.

Cones at the ends of branches; scales persistent after the seeds fall; bracts small, drying up and not apparent in ripe cones (*Abies* of Loudon, *Picea* of Link, and *Tsuga* of Carrière).
  Cones cylindric, pendulous, 4-6 in. long; leaves green . 1. *A. Smithiana.*
  Cones ovoid, spreading or drooping, 1 in. long; leaves white beneath . . . . 2. *A. dumosa.*
Cones lateral, erect; scales fall with the seeds (*Picea* of Loudon, *Abies* of Link) . . . . 3. *A. Webbiana.*

I follow Asa Gray, Botany of Northern United States, 471, and Willkomm, Forstl. Flora, 58, in uniting *Abies*, *Picea*, and *Tsuga*.

1. **A. Smithiana,** Forbes, Pinetum Woburnense, t. 36; Cleghorn, l. c. t. 5.—Syn. *A. Khutrow*, Loudon; *A. spinulosa*, Griffith; *Pinus Smithiana*, Wall. Pl. As. Rar. t. 246; *P. Khutrow*, Royle Ill. t. 84; *Picea Morinda*, Link. in Linnæa, xv. 522. Vern. *Wesha*, *bajūr*, Afg.; *Kachan*, *kachal*, Hazara and Kashmir; *Rewari*, *ban lūdar*, *sangal*, *salla*, *salle*, *sarei*, *kāuli*, *roi*, *rāg*, *rāo*, *bang re*, *krok*, Panjab Himalaya; *Landar*, *anandar*, timber depots in the plains; *Rau*, *raiang*, *re*, Sutlej; *Rāi*, Jaunsar; *Kandre*, *re*, *rhāi*, *rāo*, *kudrau* (*khutrau*, Royle), *riālla*, *rāgha*, *morinda*, *kail*, *kilu*, Garhwal and Kamaon; *Seh*, Sikkim.

A large tree with tall straight stem, pyramidal crown, dark-green foliage, and pendulous branchlets. Leaves single, scattered in spirals all round the branches, persistent 5 years, stiff, sharp, 4-sided, 1-1½ in. long. Cones terminal, pendulous, cylindric, obtuse, 4-6 in. long, 1-2 in. diam., dark brown when ripe; scales broadly ovate from a cuneate base, upper edge thin, sharp, rounded. Seeds small, 2½ lines long, with large spathulate wings.

Afghanistan, Kafiristan, Gilgit, north of the great bend of the Indus. Common in the Panjab Himalaya, in Jaunsar, and in the Bhagirati forests, less common in Kamaon. Is generally found on northern and western slopes, between 6000 and 11,000 ft., alone, but more commonly in mixed forests with leaf-bearing trees, or associated with *Deodar*, *Pinus excelsa*, and *Abies Webbiana*, growing 500 ft. higher than *Abies Webbiana* on the Harang Pass in Kunawar, but generally remaining below the upper limit of that tree. In lower Kunawar *A. Smithiana* is commonly associated with Deodar; it forms a large proportion of the Dippi, Jani, and Punang forests, some of those in the Baspa valley, and of the Barang forests above the mouth of the Baspa river. It does not, however, extend into the arid tract, its upper limit being Pangi on the right, and the Tidong river (Rispa) on the left bank. In upper Kunawar *Pinus Gerardiana* takes its place in the Deodar forests. In Sikkim and Bhutan *A. Smithiana* grows in the innermost valleys between 7800 and 10,000 ft. Hardy in England and Scotland, where it grows with great vigour, often grafted on the common Spruce.

In April a flush of young light-green leaves at the tips of the branchlets gives the tree a variegated appearance, the old foliage being dark green, slightly darker than that of Deodar, but not so dark as *A. Webbiana*. The bud-scales generally cohere, like a conical cap at the end of the young shoots, until they at last fall off. The flowers appear in April, the young cones increase in size rapidly and ripen in Oct. and Nov. of the same year. In the N.W. Himalaya the tree attains 100-120, and sometimes 150 ft., with a girth of 8-10, often of 12-15 ft. Dr Stewart records one of 21 ft. The tree is covered with branches down to the ground, except where it grows in compact masses; the branches are whorled and horizontal, spreading out farther than those of *A. Webbiana*; their extremities are very bushy, with numerous hanging vertically, leafy, tassel-like branchlets, which give the tree a peculiar and graceful appearance. The crown is tall, conical, and the foliage dense. The bark is pale- or brownish-grey, tesselated by shallow cracks into small irregularly four-sided scales.

The wood is white, the outer wood turning red and decaying rapidly. It is even- and straight-grained, and is good for packing-cases, planking and indoor work, but as a rule not durable, except under shelter; yet in many places it is used by the hill people for shingles, and for construction. It is generally somewhat heavier than the wood of *A. Webbiana*. The bark is used to roof shepherds' huts, and water-troughs are made of it. Twigs and leaves furnish litter and manure. The young cones form part of the drug sold as *gas-pipal* in the Panjab bazars.

Nearly allied to *A. Smithiana* is the *European Spruce*, *A. excelsa*, DC.—Syn. *Pinus Abies*, Linn.; *Picea excelsa*, Link.; *Epicéa*, Fr.; *Fichte*, *Rothtanne*, Germ.; *Pezzo*, It., extensive forests of which are found in the mountains of Central Europe, in East Prussia, the Baltic provinces, Norway and Sweden, and in a great part of Russia. On the south side of the Alps the Spruce forms large forests in Friaul on the head-waters of the Piave and Tagliamento rivers, which have from time immemorial furnished building timber to the eastern Mediterranean. The fact that most of these belong to towns and villages, has enabled the communities of these districts to build roads, bridges, and schools, and has thus served largely to increase the prosperity of the country. It is found in the Cansiglio forest near Treviso; on the maritime Alps, inland of Nice and Mentone, where it descends to 1800 ft. (M. Moggridge), on the north side of Mount Ventoux, and on the Pyrenees, but it is wanting in Turkey, in Italy south of the Euganean hills, in Corsica, and in Spain. It is not indigenous in

Western France, or in Britain. A variety with smaller cones (Siberian Spruce) forms large forests on the Ural Mountains, in Siberia, and Dahuria. In plantations the Spruce succeeds more readily than most conifers. It is the principal tree in the forests of the higher Harz, and of a great portion of the Saxon forests, where it is almost exclusively regenerated by planting. On the other hand, on the Schwarzwald, on the Vosges, and on the Jura, it reproduces itself without difficulty from self-sown seedlings. The resinous ducts of the wood are few and small, but the bark is highly resinous, and in former times the Spruce on the Schwarzwald and in Thuringia were largely tapped for resin. For this purpose a narrow longitudinal cut was made into the bark to the wood, and the dry resin which collected in this channel was from time to time scraped off; the cut was occasionally enlarged, and thus old trees may still be seen on the Schwarzwald the trunks of which are furrowed with numerous deep longitudinal channels, 4-5 ft. long. The wood of the Spruce, however, is much more liable to dry-rot than that of *P. Pinaster*, and the result is that almost all the old Spruces tapped for resin are found rotten in the heart as high up as the channels, and often higher, so that the lower part of the stem is useless. Apart from this, there are other circumstances, not yet sufficiently investigated, which often cause unsoundness in the heart of the Spruce. The wood, known in England under the name of *White Pine*, or *White Deal* (imported from Norway and the Baltic), has no distinct heartwood, and the cub. ft. weighs between 21 and 37 lb. (Nördlinger).

2. **A. dumosa**, Loudon.—Syn. *Pinus dumosa*, Don Prodr. Fl. Nep. 55; DC. Prodr. xvi. ii. 429. *P. Brunoniana*, Wall.; Pl. As. rar. t. 247. *Hemlock Spruce*, of Nepal. Vern. *Tangshing*, *changathasi dhūp*, Nepal; *Semadūng*, Sikkim.

A large tree with spreading branches and pendulous branchlets. Leaves narrow-linear, ½-1 in. long, edge recurved and finely serrulate near the apex, covered beneath with a white mealy substance. Male catkins short, subglobose, axillary, shorter than leaves, pedunculate; numerous lax ovate bracts at the base of peduncle. Cones terminal, erect or horizontal, ovoid, 1 in. long, scales persistent, broad-elliptic, obtuse, bracts not apparent when the cone is ripe. Seeds winged.

North-East Kamaon, first discovered by Capt. Webb, and found again by Mr T. Webber, late of the Forest Dept. of the N.W. Provinces, Nepal. In the inner valleys of Sikkim descending to 8000, and ascending to 10,500 ft. Bhutan, Fl. May, June. Dr Hooker records one in Sikkim 120 ft. high and 28 ft. girth, Him. Journ. ii. 108. The leaves are apt to fall from branches cut or broken off, and on this account Wallich first called it *Pinus decidua*. Not quite hardy in England; suffers from late spring frosts. Wood soft, white, not durable; bark used for roofing.

The *Hemlock Spruce* of Canada, *A. canadensis*, Michaux, with short linear distichous leaves, white beneath, and small terminal drooping cones, is a large tree of Canada and the northern United States. Wood not durable, and often spirally twisted, but the bark extensively used for tanning leather. Hardy throughout North Europe.

The *Douglas Spruce*, *A. Douglasii*, Lindl., is a tree forming extensive forests in the valleys of the Rocky Mountains, in Vancouver's Island, Columbia, and other parts of North-West America, which attains 300 ft. and more near the coast of the Pacific, and furnishes valuable timber, very strong, believed to be equal to the best Larch, has narrow-linear leaves 1 in. long, white beneath, and cylindric cones 3 in. long, with lax rounded scales, much shorter than the linear-oblong persistent bracts, which are deeply trifid at the apex, the middle segment longest, ½ in. long, spinescent. Hardy, and of very rapid growth in England and Scotland. Introduced 1827; at Dropmore there is a tree which, at the age of 44 years, was 100 ft. high with 9 ft. 7 in. girth, at 3 ft. above the ground. Many specimens in Perthshire raised from layers and cuttings since 1846, were in 1871 40-70 ft. high (Gardeners' Chronicle, 1870).

3. **A. Webbiana**, Lindl.; Pinetum Woburnense, t. 41; Link in Linnæa, xv. 532; Griff. Ic. Pl. As. t. 371.—Syn. *A. Pindrow*, Royle Ill. t. 86. *Picea Webbiana*, Loudon; Cleghorn, l. c. t. 6. *P. Pindrow*, Loudon. *Pinus spectabilis*, Lambert; Don Prodr. Fl. Nep. 55. *P. Webbiana*, Wall.; DC. Prodr. xvi. ii. 425. *P. Pindrow*, Royle; ib. 424. *Himalayan Silver Fir*. Vern. *Palūdar, rewari*, Jhelam; *Badar, būdar, tūng*, Kashmir; *Dhūnu, rāg, rail, pe, re, salle, sara*, Chamba; *Tos*, Kullu; *Spun, pun, krok, kalrai*, Kunawar; *Bharda, thanera*, Shali; *Pindrau, pindrai*, Hattu; *Kūdrom*, Muttiana; *Burūl, būrra, būldu*, Baji; *Kalrai, satrai, chūr*, Kotkai; *Raho, row, chilrow, kilaunta*, Chūr; *Morunda, morinda*, Taroche, Jaunsar, and Garhwal; *Chilrow*, Kullū, Garhwal; *Ragha, rao ragha, ransla, raisalla*, Kamaon; *Wūman*, Byans; *Gobria*, (*gobra*), *salla*, Sikkim; *Dūn shing*, Sikkim, Bhutan; *Partal, palt*, Panjab plains at timber depots.

A large tree with a dense cylindric crown of dark-green foliage. Leaves single, spirally arranged all round the branchlets, but generally more or less spreading in one plane so as to appear distichous, flat, narrow-linear, 1-3 in. long, 1 line broad, narrowed into a short terete petiole, apex emarginate, or with 2 sharp teeth, under side with 2 whitish longitudinal furrows on either side of the raised midrib, upper side dark green, shining. Duration of leaves 8-10 years, catkins axillary, cylindric, obtuse, about 1 in. long. Cones erect, subsessile, cylindric or ovoid, often clustered, obtuse, 4-6 in. long, 1½-3 in. diam., dark purple or brownish purple when ripe. Scales closely imbricate, broadly cuneate or obovate, edge rounded, bracts many times shorter than scales. Seeds oblong or obovoid, half the length of the broad obovate truncate wing. Two varieties, considered as species by Royle, Madden, and Parlatore: *α. A. Webbiana*, on exposed rocky ridges at higher elevations, a smaller tree, with shorter, less bifarious leaves, and usually thicker and shorter cones: *β. A. Pindrow*, on better soil, in sheltered places, a large tree, with longer leaves and generally cylindric cones. The scales fall when the seed ripens, and leave the naked persistent axis of the cone standing upright on the branches.

North Afghanistan and Kafiristan, on the Safedkoh, between 8000 and 9000 ft. Himalaya, from the Indus to Bhutan, forming extensive forests, in the North-West, pure or mixed with *Acer* and other leaf-bearing trees, at high elevations with *Betula Bhojpattra*; often associated with *Abies Smithiana* and *Pinus excelsa*. In the Panjab it is usually found between 7000 and 11,500 ft., but descends occasionally to 5500, and ascends to 12,500 ft., which is its upper limit in Kunawar. Up the Sutlej valley it extends to Lipi on the right, and Dabling on the left side. On the Chūr its lower limit is 10,000 ft. In Jaunsar, Garhwal, and Kamaon its limits are 7500 and 13,000 ft., and here it is only found in the middle ranges at a distance of 35-40 miles from the plains. In the inner ranges of Sikkim and Bhutan *A. Webbiana* forms, with *Abies dumosa, the Yew,* together with *Oak,* large *Rhododendrons,* and *small Bamboo,* the upper zone of coniferous forest, between 9000 (sometimes 8500) and 13,000 ft. In the outer ranges it does not descend below 10,000 ft. (Hook. Him. Journ. i. 191).

In the North-West Himalaya it thrives best in cold damp glens, with a north or west aspect, and in such places it often constitutes alone, or associated with the alpine Birch, the upper forest belt; *Pinus excelsa* often going higher, and always extending farther into the arid tract. A flush of young leaves breaks out in April and May, of a bright green colour, contrasting strongly with the dark-green old foliage. At a distance the foliage looks almost black; and, like the silver fir of Central Europe, the tree has given the name of Black Forest (Kala ban) to several mountain forests of the N.W. Himalaya. Fl. April; by the end of May the cones are about 3 in. long, and they ripen in Sept. of the same year, the scales and seeds falling in October. In North Europe the tree suffers in spring, because it starts into growth too early; it succeeds in Ireland and South-West England. Attains 120-150 ft., and a girth of 9-15 ft. Several instances are recorded of trees exceeding 20 and even 30 ft. in girth. Except in very compact and dense forests, the branches go low down, nearly to the ground; they are short, spreading nearly horizontally, and forming a tall narrow cylindric crown, the outline resembling that of the Cypress or Lombardy Poplar. Bark of young trees smooth, silvery grey, of old stems darker grey or brownish grey, cut into long narrow acute scales by deep narrow vertical grooves, often running in spirals round the trunk, and anastomosing at acute angles. The wood is whitish, inodorous, open-grained and soft. Exposed to the weather it is not durable. Weight, 21 lb. (Wallich), 27-35. Value of P. (average of 10 exp.) 440, Capt. W. Jones, Oct. 1844, cut Sept. 1844. In Bhutan the wood is used for house-building; from Sikkim it is exported to Tibet. "It splits well, is white, soft, and highly prized for durability," Hook. Him. Journ. ii. 44. In Kullu and near Marri shingles are made of it; indoors it is said to last 3-6 years in Kullu, and 8-10 years at Marri. In the dry climate of Lahoul and Kunawar it is much valued for construction. Pieces of the bark are employed to roof shepherds' huts. On the Jhelam the twigs and leaves are used for fodder, and are stored for the winter. According to Wallich, a violet dye is extracted from the cones in Nepal. A large yellowish fungus (*unglān*) grows on the roots in N.E. Kamaon, eagerly eaten by the Bhoteas (Madden).

The Silver Fir of Europe is *A. pectinata,* DC.—Syn. *Pinus Picea,* Linn.; *P. Abies,* Du Roi; *Picea pectinata,* Loudon: *Sapin,* Fr.; *Tanne, Weisstanne, Edeltanne,* Germ.; *Abete, abezzo,* Ital.,—the largest of the European conifers, which, when grown in compact masses on good soil and under exceptionally favourable circumstances, attains a height of 180 to 200 ft. The leaves persist 8-10 years, they are linear, apex emarginate, dark green and shining above, and white beneath. The cones are erect as in the Himalayan Silver Fir, the bracts pointed, longer than the scales, which fall after the seed ripens. The tree is indigenous in the mountains of South and Central Europe. It forms splendid forests on the north face of the eastern Pyrenees, south of Carcassonne and Limoux in the Département de l'Aude. In Spain it is found on the mountains of Catalonia and Aragon; in Corsica it constitutes a belt of forest between the *Pinus Laricio* and the *Beech,* and is associated with the latter near the limit of arborescent vegetation. Forests of it, though unfortunately less extensive than might be desirable, are in several places on the crest of the Appenines. In the Vosges and the Schwarzwald it is the most important tree; and Silver Fir is found in some of the Spruce forests of Saxony and Thuringia. In Britain and Scandinavia it is not indigenous. While young the Silver Fir bears a great deal of shade, and is on that account particularly well suited for regeneration by self-sown seedlings. Its artificial cultivation is much more difficult and uncertain than that of the Spruce. The fine Silver Fir forests of the old convent of Vallombrosa, however, below the crest of the Appenines overhanging the Arno above Pontassieve, are an instance of successful reproduction of this tree on a large scale, continued for centuries entirely by planting. These forests are now State property, and are attached to the Royal Italian Forest School of Vallombrosa.

The stems are cylindrical, carrying their girth well up. The Silver Fir has a considerable power of reproduction; trees which have been lopped and mutilated often send up a number of leaders from their side branches, and parallel double or forked stems are not rare. The wood has very few minute resinous ducts. As regards weight, Nördlinger gives it the same range as Spruce, but Mathieu states that as a rule it is somewhat heavier (Fl. For. 365). In the same place he records that the wood of the Aude Silver Fir was found to possess a greater transverse strength and elasticity than any other coniferous timber, excepting the wood of *Pinus australis* from Florida. By puncturing the bark small quantities of turpentine are obtained.

Closely allied to the Silver Fir is the Cephalonian and Greek Silver Fir, united with it by Parlatore and Grisebach, but distinguished by Loudon, Link, and Willkomm as *A. cephalonica*, Loudon—Syn. *A. Apollinis*, Link, and *A. Reginæ Amaliæ*, Heldreich. It is supposed to be distinguished by acute, often sharply-pointed leaves, and by spindle-shaped cones. This tree forms extensive forests on the mountains of Cephalonia and Greece, generally commencing above 3000 ft., but sometimes descending to 1500 ft., often forming the upper limit of the forest where the mountains are sufficiently high, sometimes associated with *P. Laricio*. For the Indian forester this tree has a special interest, as it is one of the few abietineous trees, which are supposed to have the power of throwing up coppice-shoots from the stump. A full account of it is given by T. v. Heldreich in Regel's Gartenflora, 1860, p. 313. Two Greek Forest Officers, Balsamaki and Origoni, visited in 1859 an extensive forest of this fir in Central Arcadia in the district of Tripolitza. The inhabitants of the neighbouring villages had been in the habit from time immemorial of cutting the upper part of the stems at different heights, according to the size of the scantling required, and the result was the same as that described, p. 523, in the case of the Deodar in upper Kunawar—the side branches below the cut had sent up a number of vertical shoots, which often attained 18-20 ft. in length, and a diameter of 1½ ft., thus forming candelabrum-like trees, exactly like the Deodar in mutilated forests of the N.W. Himalaya. It was even stated that young trees cut down above the root had thrown up regular coppice-shoots. This last statement, however, seems to require confirmation. All that is proved at present is, that the Deodar and the Greek Silver Fir have (compared with other trees of the Pine tribe) great powers of reproduction; it remains for farther inquiry, whether they actually throw up coppice-shoots from leafless stumps.

A. Nordmanniana, Link, a stately tree with dark compact foliage, and ovoid cones, of late years much cultivated in England, forming forests in the Crimea and the Caucasus, is regarded as a variety of the Silver Fir by Parlatore and Grisebach.

A. Pinsapo, Boissier, is a beautiful tree with regularly whorled branches, rigid, short broadly linear thickly set leaves, erect, at right angles, all round the branches in a regular spiral. Male flowers numerous, purple. Cones cylindric-ovoid, 4-5 in. long, the bracts shorter than the seed-scales. On the Serrania de Ronda, in the province of Malaga, between 3000 and 3600 ft., and lately found on the Atlas mountains in Algeria (*A. baborensis*). Extensively cultivated in England, where it thrives remarkably well.

4. LARIX, Tournef.

Deciduous resinous trees. Leaves needle-shaped, single on elongating shoots and on the first shoots of seedlings, but otherwise in dense fascicles on arrested branchlets, which do not as a rule lengthen out and develop into side branches. Male catkins sessile, lateral on short thick scaly but leafless peduncles (stunted branchlets). Anther-cells 2, longitudinally dehiscent. Female catkins often on the same branches as the male, at the ends of arrested leaf-bearing branchlets. Ovules inverted, in pairs at the base of the carpellary scales, these in the axils of cuspidate, 1-nerved bracts, which are longer than the scales. Cones erect; scales persistent, with a thin obtuse edge; bracts generally protruding between the scales when the fruit is ripe. Seeds oily, winged.

1. **L. Griffithii**, H. f. & Th.; Hook. Ill. Him. Pl. t. 21.—Syn. *Pinus Griffithii*, Parlat. in DC. Prodr. xvi. ii. 411. Vern. *Sah*, *saar*, Sikkim.

A graceful tree with conical crown and long pendulous branches. Leaves slender, narrow-linear, about 1 in. long. Male catkins ovoid-cylindric, ½ in. long. Cones cylindric, 2-3 in. long, erect—*i. e.*, on recurved branchlets on the pendulous branches. Bracts reflexed, subulate, twice the length of the carpellary scales, persistent in fruit.

Inner ranges of West Bhutan, Sikkim, and East Nepal, between 8000 and 12,000 ft. Said to extend west to the sources of the Dūd Kosi river, which descends from Mount Everest. Fl. May, the fruit ripening in Oct. of the same year. Wood white, soft, without heartwood, but splits well, and is reckoned the most durable of the coniferous timbers exported into Tibet from Sikkim (Hook. Him. Journ. ii. 44).

The European *Larch* is *L. europæa*, DC.—Syn. *Pinus Larix*, Linn.; *Lärche*, Germ.; *Mélèze*, Fr.; *Larice*, Ital.—a large tree with small ovoid cones 1-1½ in. long, the bracts dry when the cones ripen, and barely protrude beyond the lower carpellary scales. Indigenous in the Alps and Carpathian mountains, forming extensive forests in the French Alps, pure, or mixed with *Pinus Cembra* and *P. montana*, less abundant, and generally associated with the Spruce in Switzerland, the Bavarian and Austrian Alps. It ascends to the limit of arborescent vegetation, and is not rarely the highest tree in company with the *Spruce* and *P. Cembra*. The Siberian Larch, *L. sibirica*, Led., which forms large forests in the plains of Russia and Siberia, and is found on the Ural and Altai mountains, is a different species. The heartwood of the European Larch is well defined, red, compact, even-grained, strong, and very durable, does not warp nor split, and is prized more than Oak in the mountains where it is indigenous. Resinous ducts numerous, small or moderate-sized. The Romans prized the wood much. Pliny mentions a beam 116½ ft. long and 23¼ in. square, brought to Rome by the Emperor Tiberius. The cubic ft. weighs 27-49 lb., and even more. On account of the value of the wood, its rapid growth, and the certain success of plantations while young, the Larch has been cultivated on a very large scale far beyond the limits of its natural habitat, particularly in Germany, Scotland, and France. Speaking broadly, the result is favourable up to a certain age. Larch plantations, which are cut down at the age of 40-60 years, have in many instances been found to give most satisfactory results; beyond that age, however, its progress is not satisfactory on a large scale, and a disease has shown itself of late years which has in many cases seriously injured plantations of much younger age. Considerable quantities of Larch seed have at different times, by well-meaning persons, been imported to the N.W. Himalaya, but as yet without any result. Except on the borders of the arid tract, beyond the range of the Deodar—*e.g.*, in Lahoul, Piti, and Ladak—there seems no inducement to repeat these experiments, as the Deodar is at home in the N.W. Himalaya, and is fully equal in value and in rapidity of growth to the best mountain Larch. The wood of the Larch yields large quantities of turpentine, which is used medicinally under the name of Venetian turpentine. A number of holes, about 1 in. diam., and somewhat inclined towards the circumference, are bored into the trunk, but not quite to the heart of the tree, small channels of wood are inserted in each hole, and the turpentine which runs out during summer is collected in wooden buckets placed underneath. Holes that cease to run are closed, and yield a fresh supply when reopened. In autumn all holes are carefully closed with wooden stoppers, and if this precaution is duly observed, it is said that a tree will continue to yield during 40-50 years; but the wood of the trees thus tapped is said to lose its good quality, and can only be used as fuel. This is the practice in the valley St Martin, Pignerolo district of Piedmont, between Mont Cenis and Monte Viso. It is described by Duhamel in his 'Traité des Arbres et Arbustes,' 1755, and quoted by Mohl. The editor of the 'Nouveau Duhamel' (1812), states that it is the practice in the Swiss Canton de Vaud, probably a mistake. In South Tyrol one hole only, 1 in. diam., is bored about a foot above the base of the trunk fully to the centre in spring, and is at once firmly closed by a wooden stopper. In autumn the hole is opened and emptied of the turpentine which has collected in it during summer, and is then closed again. It is again opened and emptied in the second autumn, and so on during a number of years. In this way all large trees are tapped in certain forests of South Tyrol, as described by Mohl in 'Botanische Zeitung,' 1859, p. 329, and the wood of the trees thus tapped is said not to deteriorate in any way. Mohl's paper discusses the connection between the different modes of tapping coniferous trees for resin and the distribution of the resinous ducts in wood (*Larch*, *Pinaster*, and *Laricio*), and bark (*Spruce* and *Silver Fir*). The bark of the Larch is used for tanning and for dyeing.

5. CUPRESSUS, Linn.

Evergreen aromatic trees, with small closely adpressed scale-like broad-based opposite leaves, imbricate on the younger branchlets, distant, decussate, and often less closely adpressed on older branchlets. Male catkins numerous, small, cylindrical, sessile at the ends of branchlets; scales stipitate, peltate, each bearing 2-4 subglobose anther-cells under the edge. Female catkins terminal, fewer than male; scales few, decussate, each bearing at the base 8 or more erect ovules narrowed at the apex. Cone subglobose, requiring somewhat longer than a year to ripen, consisting of thick woody peltate, angular scales, with numerous seeds, attached to the stalk of the scales. Cotyledons 2-3.

Crown narrow-cylindrical; branches erect; cones few, 1 in. diam.	1. *C. sempervirens.*
Crown broad-pyramidal; branches spreading; cones numerous, clustered, ½ in. diam.	2. *C. torulosa.*

1. **C. sempervirens**, Linn.; DC. Prodr. xvi. ii. 468; Reichenb. Ic. Fl. Germ. t. 534. In India only the cylindrical (so-called pyramidal) variety occurs, *C. fastigiata*, DC. *Cypress.—Cipresso*, Ital. Vern. *Saru, sarw, sarās*, N.W. India.

A tall tree with a fluted stem; branches erect, often adpressed to the trunk, forming a narrow dense cylindrical crown of dark-green foliage. Branchlets four-sided, leaves ovate-oblong. Cones few, 1 in. diam., and grey when ripe, greatly varying in shape, on peduncles ¼ in. long; scales rough, with a projecting point or boss, convex or keeled. Seeds ovoid or oblong, angular, with a narrow wing.

Planted in gardens in Afghanistan and N.W. India, *e.g.*, at Agra, Ajmir, Delhi, also in Kashmir and the outer Himalaya, in Kamaon to 3000 ft. Grows in Calcutta. Cultivated throughout the Mediterranean region. Hardy in England. The pyramidal variety is not found wild anywhere; the variety with spreading branches, regarded by Grisebach and others under the name of *C. horizontalis*, as a distinct species, is wild on the west side of Lebanon, on the mountains of Crete and Asia Minor, and probably also in North Persia. Fl. Feb.-April; the fruit ripens during summer of the second year, and is often long persistent on the tree. In N.W. India the tree attains 6-7, occasionally 9 ft. girth, and 70-80, occasionally 100 ft. in height. Its growth is slow; Grisebach mentions two cypresses found by him near a convent on Mount Athos, proved by inscriptions to be more than 1000 years old, the radius of which had increased at the rate of $\frac{1}{20}$ inch only a-year. Near Somma, in Lombardy, a cypress is shown which was renowned in Cæsar's time on account of its size and beauty. The bark is thin (less than ⅛ in.), dark grey or brown, with numerous longitudinal wrinkles and shallow furrows. The wood is reddish- or brownish-white, close-grained, but not hard, the inner belt of each annual ring (spring wood) soft, the outer belt (autumn wood) harder and reddish. Medullary rays numerous and distinct. Very fragrant, with a strong peculiar and pleasant scent. It is exceedingly durable, and in the Levant and Greece is prized for trunks and boxes, the contents of which are proof against most insects.

2. **C. torulosa**, Don; Prodr. Fl. Nep. 55.—*Himalayan Cypress.* Sans. *Surāhva.* Vern. *Devi diār*, Ravi; *Deodar*, Kullu, Baji; *Leauri*, Jaunsar; *Raisalla*, Naini Tal.

A large tree; branches horizontal, whorled, with drooping extremities, forming a broad pyramidal crown. Branchlets round or indistinctly four-sided; leaves ovate-triangular, white-margined. Cones numerous, clustered, erect, bluish when ripe, ½ in. diam.; scales flat or convex, rugose, but smoother than those of *C. sempervirens.* Seeds compressed, convex on both sides, with a narrow orbicular wing.

Outer ranges of the Himalaya from Chamba to Nepal, but more local and less common than most other Himalayan conifers, generally, but not always on dry warm rocky slopes. Several small patches on the Ravi, more abundant in part of Kullu, between 5500 and 8000 ft. (not in Mandi, where, according to Stewart, Vigne and Moorcroft mistook a small Deodar forest for Cypress.) Common, on limestone, on the north side of the Shali and Tikka ridge north of Simla, associated with *Deodar*, *Abies Smithiana*, *A. Webbiana*, and *Taxus.* In Jaunsar, on the limestone rocks of the Lokandi and Moila Hills, on limestone below the Karama Peak, associated with *Deodar* and *A. Smithiana.* On the south-east face of Chinar Peak, above Naini Tal, on clay-slate, but in the vicinity of limestone rocks. Not uncommon in Garhwal and Kamaon, and in Nepal. Grows at Saharanpur, at Poona, at Calcutta, and thrives vigorously on the Chikalda Hill in Berar at 3000 ft. elev. Madden states that the tree is indifferent to the nature of the rock, and that it is found both on limestone and on silicious rocks. What I have seen of its growth makes me think that it prefers limestone. Fl. Jan.-Feb., the cones ripen in Oct.-Nov. of the second year, and are often long persistent on the trees. Attains generally 70-80 ft., and a girth of 6-8 ft., but larger trees are not uncommon. Dr Stewart records one near Girar on the Belj, a feeder of the Ravi, at 6500 ft., 15 ft. girth, and over 120 ft. high; and Madden speaks of 15-17 ft. girth, and a height of 150. The roots often embrace masses of rock, and the base of the trunk swells out in such cases. At Naig, south of Lobha, Stewart records a famous grove, the trees 12-17 ft. girth, and one 27 ft. girth near the ground, with enormous roots clasping great rocks, probably not under 1000 years old. The growth, as far as known, appears to be slow. Dr Stewart records 12-18 rings on one inch of radius. Bark very thin, barely ¼ in. thick, the outer layer peeling off in numerous long narrow dark-grey thin strips, which are often spirally twisted round the trunk; inner substance of bark reddish brown. The surface of the bark is rougher and darker than that of *Juniperus excelsa*, with which this Cypress is often confounded. Wood white, with a tinge of red or yellow, deeper coloured in the centre, fragrant, the scent similar to the scent of the Cypress wood from Turkey and Greece, even-grained, not hard, easy to work, but not strong. Medullary rays distinct, somewhat darker than the rest of the wood, annual rings consist of an inner softer and an outer harder and darker belt. At Naini Tal it has been much used for building, particularly for indoor work, and on the Ravi and Sutlej it is sometimes used for beams. But, as a rule, the tree is not used for secular purposes. In Kullu images are made of it, and the poles to carry the sacred ark, for which purpose Birch and Elm are also employed. The wood is often burnt as incense in temples.

C. glauca, Lam.; DC. Prodr. xvi. ii. 470; Dalz. Bomb. Fl. Suppl. 83.—Syn. *C. lusitanica*, Willd. Commonly cultivated in gardens in Western India above Ghat; does not succeed below Ghat, according to Dalzell. Largely cultivated in Portugal, believed to have been introduced from Goa. Supposed to be distinguished from the two preceding species mainly by the bluish colour of the leaves and cones, and by the projecting subulate boss of the scales. The value of the former character, however, is demonstrated by the Deodar, which is commonly bluish when cultivated in Europe, and occasionally in the Himalaya, but the great mass of which, in its native forests, is dark green. The character taken from the scales of the cone may be more constant, but the specific distinctions between the three Cypresses described, *sempervirens*, *torulosa*, and *glauca*, seem to invite farther inquiry.

C. funebris, Endl.; the weeping Cypress—Vern. *Chandang*, Sikkim—an elegant tree, with hanging distichous branches and lanceolate mucronate leaves, with a spreading apex, is planted in China near pagodas, also planted in Bhutan near temples and monasteries, between 2000 and 7000 ft., and on the great Ranjit river in Sikkim near convents and cemeteries; also in Nepal. Grows at Calcutta.

Biota orientalis, Endl.—Syn. ***Thuja orientalis***, Linn., the ***Arbor vitæ***, is a small evergreen tree, indigenous in Japan and China, much cultivated in India and Europe, with the foliage similar to that of the Cypress, but the cones consisting of 3-4 pairs of decussate oblong woody scales, with the apex recurved, and at the base of each 1 or 2 unwinged seeds.

Callitris quadrivalvis, Vent.; DC. Prodr. xvi. ii. 452.—Syn. *Thuja articulata*, Vahl—is a small tree of Western North Africa, where, according to Mathieu, it covers large areas either alone (Fl. For. 355), or mixed with *Pinus halepensis*, *Phillyrea*, and other evergreens, and is remarkable on account of the compact heavy and very fragrant heartwood, which has a rich brown colour, and takes a most beautiful polish. The tree coppices readily, and the forest-fires, which are lighted by the Arab herdsmen (as they are by the pastoral population of India), frequently kill the stem to the ground, when abundant shoots spring up from the root, which attains a great age, and often a considerable size. These masses of root have a beautifully mottled grain; exquisite ornaments and small articles of furniture are made of them, and veneers for the most elegant cabinet-work. This wood was one of those called Κέδρος, *citrus* (see p. 56), was highly prized by the Romans, and fabulous prices were paid for tables made of it. The branchlets are green, articulate, and bear at the base of each joint 4 minute decussate scale-like leaves. The fruit is ½ in. diam., four-sided, consisting of 4 valvate scales, and containing 6 winged seeds. The tree exudes a strongly-scented resin (Gum Sandarach).

6. JUNIPERUS, Linn.

Evergreen trees or shrubs, with distinct, generally red-coloured heartwood. Leaves either all linear or subulate, erect or spreading, in whorls of three or dimorphous, viz., on the first shoots of seedlings, and on luxuriant shoots, subulate and spreading, and on the other branches scale-like, opposite, generally decussate, and imbricate. Flowers monoicous or dioicous, terminal or axillary. Male catkins small, cylindrical or ovoid; scales whorled, imbricate, bearing each at its base 3-6 anther-cells. Fruit ripening the second year, fleshy, subglobose, consisting of 3-6 connate carpellary scales (the lower sterile), the tips of which are often visible on the surface of the ripe fruit. Seeds 1-3, with coriaceous testa embedded in the resinous pulp of the berry (galbulus).

All leaves whorled, erect or spreading, linear, pungent; catkins axillary . . . . 1. *J. communis.*

All leaves whorled, subulate, pungent, the upper adpressed, imbricate; male catkins terminal; female catkins at the ends of short lateral branchlets . . . . . . 2. *J. recurva.*

Leaves dimorphous, those on the great mass of branches scale-like, decussate, adpressed and imbricate, on others subulate, pungent, erect or spreading.

  Foliage bushy; branchlets four-sided; the scale-like leaves oblong, more or less keeled at the back, apex not closely adpressed; berries ovoid, subacute, 1-seeded. (A shrub in the N.W. Himalaya, in Sikkim a tree) . . . . 3. *J. Wallichiana.*

  Foliage light and open; branchlets spreading, indistinctly four-sided; the scale-like leaves ovate, convex, closely adpressed, with a large resinous gland on the back; berries globose, very resinous, 2-5-seeded. (A tree in the N.W. Himalaya) . . . . 4. *J. excelsa.*

1. **J. communis**, Linn.; Hook. Stud. Fl. 348; Reichenb. Ic. Fl. Germ. t. 535.—*Juniper*. *Genévrier*, Fr.; *Wachholder*, Germ. Vern. *Nŭch*, *pāma*, *pethra*, *bentha*, *betar*, Kashmir, Chamba, and Kullu; *Lang shūr*, *thelu*, *lewar*, Kunawar; *Chūni*, *shūpa*, Piti.

A dense, diffuse shrub, in Europe sometimes a small tree, procumbent at great elevations. Foliage greyish green. Leaves spreading, in whorls of three, linear, ¼-½ in. long, pungent, narrowed at base, nearly flat and bluish green above, light green, convex or obtusely keeled beneath, persistent 3-4 years. Catkins axillary, supported at the base by small bracts; the male ovoid, yellow; the antheriferous scales broad-ovate, acuminate; the female flowers small, resembling leaf-buds. Berries subglobose, on short scaly stalks ¼-⅓ in. long, crowned at the apex with the tips of the carpellary scales; pulp sweet and resinous. Seeds generally 3.

South side of Safedkoh at 9000 ft. North-West Himalaya, but not in the innermost arid tract, abundant in places as far east as the Sutlej, less common beyond it. Hills near the mouth of the Sindh valley, Kashmir, at 5400 ft.; in the Butna valley ascending to 11,000; in Lahoul to 12,500 ft.; in Kunawar between 9000 and 11,000 ft.; to 14,000 ft. on the Bias and in Garhwal; easternmost point entrance of the Biāns valley in North-East Kamaon. Throughout Europe to the North Cape. In Greenland, North Asia, also on the Caucasus and on Mount Ararat. In North and Central Europe it is found both on the plains and on mountains. On the Riviera, near Nice and Mentone, it goes down to the coast, but farther south it is found on mountains only. Thus in Spain it occurs (according to Willkomm) on the Guadarama mountains from 3500 to 6000 ft., in the Sierra Nevada from 6500 to 8000, and on Mount Athos in Macedonia (according to Grisebach) from 5200 to 6000 ft. *Juniperus nana,* Willd., which many botanists consider as a variety merely of the common Juniper, ascends even higher, and is found in the Alps and on the mountains of South Europe, in the Alpine zone far beyond the forest belt. On the dry stony hills of the Muschelkalk formation in North and Middle Germany the Juniper is sometimes a useful nurse of plantations, and it often affords shelter in such localities to self-sown seedlings of other trees. In East Prussia and the Baltic provinces the Juniper is often gregarious, covering large extents of ground with open brushwood; and under partial shelter it becomes arborescent, extending over large areas, associated with other trees (Willk. Forstl. Fl. 217). In the North-West Himalaya the Juniper is chiefly found on high dry bleak slopes, usually gregarious, sometimes mixed with *J. recurva,* often in patches forming a belt above the upper limit of the forest. Fl. March, April; the fruit ripens in August and September of the second year.

Generally an irregularly-shaped shrub with stiff branches, branchlets erect or spreading, procumbent at high elevations. In the Himalaya it rarely attains more than 6-7 ft. with a disproportionately thick stem, 18-24 in. girth. In Europe the tree occasionally grows 30-40 ft. high with a girth of 4-5 ft. Bark whitish grey, exfoliating in thin flakes, leaving the brown inner substance exposed. Sapwood large, white; heartwood brown, fine-grained, compact, the annual rings distinctly marked by a dark narrow line. Used for fuel, very acceptable on high passes. The twigs are resinous and aromatic; they are placed before the Deota in temples, and, like the wood, are burnt as incense (*dhūp*). The fruit is sweet, aromatic, and very resinous. In Kamaon it is added to spirits distilled from barley. (In North Germany the berries are largely collected and exported to Holland for the manufacture of gin.) They are sold as medicine in the bazars of North India under the name of *Abhūl, hūber,* administered in decoction as a stimulant, diuretic, and emmenagogue.

2. J. **recurva**, Ham.; DC. Prodr. xvi. ii. 481.—*Weeping Blue Juniper*, Hook. Him. Journ. ii. 28. Vern. *Wetyar, bettar, chūch, thelu, telu,*

talu, phulu, Pb.; *Bettir, bhedāra, bendhāra, bidelgunj, thelu, phulu, jhora, gūggal, bil, ūrū, agāni,* N.W.P.; *Pāma,* Tibet; *Deschū,* Sikkim.

A gregarious shrub or moderate-sized tree; branchlets decurved or drooping. Leaves adpressed, ⅛ in. long, in whorls of 3, generally approximate and imbricate, distant on older branchlets, lanceolate, pungent, back convex. Catkins and berries at the ends of short lateral leaf-bearing branchlets. Berries oblong or ovoid-oblong, pointed, ⅓-½ in. long, with the tips of carpellary scales near the apex, green at first, olive or blue afterwards, dark-brown or almost blackish-purple, smooth shining when ripe. Seed 1, oblong, obtuse.—*J. squamata* is a procumbent variety with broader, curved leaves.

South side of Safedkoh near Pewar Pass 8000-9000 ft. Himalaya 7500 to 12,000 ft., ascending to 13,000, and on the Niti Pass to 15,000 ft. In Sikkim and Bhutan at 9000-12,000 ft. Occasionally planted near temples, *e.g.*, at Panwi in Kunawar. Fl. chiefly in June, July; the fruit ripening July to October of the second year. In Sikkim and Bhutan attains 30 ft. with a pyramidal crown, and drooping branchlets. In the North-West Himalaya it is only known as a gregarious shrub, often covering large areas, either pure or mixed with *J. communis*, the stems decumbent, at times 6 in. diam., very long, running over or under the surface of the ground, and from these creeping stems rise numerous short erect branches, which make it very difficult to traverse such thickets. Bark smooth, cinnamon-coloured, generally peeling off in conspicuous flakes which curl up. Heartwood reddish-brown, fragrant, useful as fuel at high elevations. The sprigs are used in the distillation of spirits; coarse barley-flour is made into balls, covered with the sprigs and leaves, wrapped up in blankets and kept warm for 3-4 days until it ferments, when it is used in the distillation of arrack from rice. The shrub is sacred, and the resinous twigs are used for incense (*dhūp, gūgal*).

3. **J. Wallichiana,** Hf. & Th. in Herb. Kew.—*Black Juniper* of Sikkim, Hook. Him. Journ. ii. 55. Vern. *Tchokpo,* Sikkim.

In the north-west a large gregarious shrub, in Sikkim a large tree, with densely massed bushy branchlets. Leaves dimorphous, the scale-like leaves oblong, back almost keeled, obtuse, in 4 rows, so as to make the branchlets 4-sided, apex not quite adpressed, those on the lower branchlets linear, pungent, and somewhat spreading. Male catkins terminal. Berries numerous, erect, on lateral leaf-bearing branchlets of variable length, ovoid, acute, ¼-⅓ in. long, blue, shining when ripe, 1-seeded.

Himalaya 9000 to 15,000 ft. from the Indus to Sikkim. Fl. April, May; fr. Aug. Bark brown, smooth, exfoliating in large flakes. This is the large tree Juniper of the inner ranges of Sikkim, attaining 60 ft., with spreading branches. The wood of the Sikkim tree resembles *J. excelsa* in structure.

J. Pseudo-Sabina, Fisch. et Meyer; Ledeb. Fl. Ross. iii. 682, a shrub of Siberia, mountains of Davuria and Songaria, is identified with this species by Parlatore in DC. Prodr. xvi. 482; but the fruit, which is 1-seeded like that of *J. Wallichiana,* is described as recurved, not erect. The classification of the Junipers of Asia seems to require critical revision.

4. **J. excelsa**, M. Bieb.—**Tab. LXVIII.**—DC. Prodr. xvi. ii. 484.—Syn. (partly) *J. chinensis*, Linn., as accepted by Parlatore in DC. Prodr. 487. *Himalayan Pencil Cedar. Apūrs, ūppurz*, Beluchistan; *Chalai, chalei*, Jhelam; *Shūkpa, shūr, shūrgu, lewar*, Chenab and Sutlej; *Shūr-būta, shūrgū, shūkpa*, Tibet; *Dhūp, padmak, sūrgi*, N.W.P.; *Dhūpi, dhupri chandan, shūkpa*, Nepal.

A small or middle-sized tree, stunted at high elevations, with slender, terete, nearly distichous branchlets. Foliage light green, not unlike in colour that of *Pinus excelsa*. Leaves of two kinds (dimorphous), on the upper and outer branches scale-like, closely adpressed, imbricate, ovate, acute or pungent, back convex with a resinous gland; on the lower branches, subulate, pungent, ⅓ in. long. Male catkins terminal. Berries very resinous, ¼ in. diam., subglobose, black when ripe, at the ends of lateral leaf-bearing branchlets of variable length, ⅛-½ in. long, seeds 2-5.

Afghanistan and North Beluchistan. Arid tract of the North-West Himalaya and West Tibet, generally gregarious on rocky slopes. At the head of the Kunhār river (the westernmost feeder of the Jhelam), in Kaghan, at the head of the Sind river in Kashmir, on the upper Chenab, Bias and Sutlej (above the Tidong valley and the Werang Pass), on the upper Indus and its tributaries, and at the head-waters of several feeders of the Ganges. Said to be plentiful in inner Nepal, but not found farther east. The range of elevation is from 5000 ft. (Rondu on the Indus) to 14,000 ft. in Ladak. It grows at the Saharanpur garden, and is hardy in England. Beyond India it is difficult to define the limits of this tree, as there are several species closely allied to it which will be noticed below. The Indian tree seems to be identical with that found in the Crimea, on the Caucasus, and the Ural mountains. In the N.W. Himalaya it flowers in summer, and the berries ripen in September of the second year. The tree does not generally attain a height exceeding 50 ft., the trunk is short, but of great girth, 10 ft. and 6-7 ft. at higher elevations (11,000 ft.) being not uncommon, and several over 20 ft. girth being known. The trunk is generally crooked and gnarled, and divides into many large, diffusely spreading twisted boughs, which rapidly diminish in girth, and grow to no great height. An extreme specimen is in Lahoul, 33½ ft. girth, divided into contorted branches not over 30 ft. high. The crown has often an irregular and grotesque shape. The branchlets are slender, glaucescent, erect or spreading, shorter and less pendulous than those of *Cupressus torulosa*, but very like it in hand specimens. Bark of branchlets reddish-brown, shining, with a cinereous silvery pellicle peeling off. The bark of the trunk is reddish-brown or grey, smooth between longitudinal cracks, exfoliating in long fibrous strips. Inner substance compact, fibrous. The rate of growth is slow, three sections recorded by Stewart gave 24, 40, and 44 rings per inch of radius respectively. The sapwood is large, light-coloured, the heartwood light or dark red, even- and close-grained, with a scent similar to that of the pencil cedar, but less powerful; it is much harder than the American pencil cedar. Like the wood of most Junipers, the annual rings in the wood of *J. excelsa* are distinctly marked by a dark narrow line. The medullary rays are often darker than the rest of the wood. Weight, 25-37 lb. per cub. ft. In Quetta and Kelat it is much used for rafters and building. In the bare and arid tracts, where it is chiefly found, it is used for many purposes. Supports of water-channels are made of it, and the heartwood is said to be almost imperishable in moist earth. In Lahoul it is used, alternating with stones, for the walls of houses, as well as for beams. In Kunawar some of the temples are built of it; it is made into drinking-cups and walking-sticks.

At Leh it is largely used as fuel (the driftwood that comes down the Zanskar river); it burns quickly with a peculiar smell. Charcoal is made of it in places. In Kunawar it is burnt for incense, and is exported for that purpose. The fruit is very turpentiny and not eatable; under the name of *Ahŭber*, it is medicinal in Sindh, and is said to be used as incense.

The species closely allied to this are: 1. *J. chinensis*, Linn., China and Japan, very similar to *J. excelsa*. 2. *J. fœtidissima*, Willd.; DC. Prodr. xvi. ii. 485 (united with *J. excelsa* by Grisebach Veg. der Erde, i. 572). Forms forests with other conifers on the mountains of Greece, Macedonia, Asia Minor, Armenia, Syria, and is also found on the Caucasus; 1-2 seeds, according to Parlatore. 3. *J. procera*, Hochstetter, on the mountains of Abyssinia and Arabia Felix; 2-3 seeds. 4. *J. thurifera*, Linn.; Portugal, Spain, and Algeria, above 3000 ft. elevation; 2-3 seeds. All these are trees, sometimes attaining a considerable size; and in addition to them Grisebach distinguishes 5. *J. ægæa*, from the Greek Archipelago, with sessile fruit. 6. *J. Sabina*, Linn., is generally a shrub, rarely a small tree; seeds generally 1-2, rarely 3-4, Parlatore; fruit smaller than that of the preceding species, except *J. procera*, which also has small berries. The distinguishing characters between these species are somewhat uncertain.

Juniperus virginiana, Linn., *the American Pencil Cedar*, near the coast of the Atlantic from Maine to Florida, with compact scented red heartwood, and *J. bermudiana*, Linn., of the Bermudas, the West Indies, and Florida, mainly yield the wood of which pencils are made.

Juniperus drupacea, Labill.; DC. Prodr. 476—Syn. *Arceuthos drupacea*, Antoine & Kotschy—is a dioicous shrub or small tree, with large subglobose fleshy and eatable fruit 1 in. diam., consisting of 9 scales, the tops of which are prominent in 3 whorls, 6 near the apex and 3 at the base of the fruit. Leaves in whorls of three, lanceolate, rigid, pungent, ¾ in. long, 1-1½ lines broad. Mountains of Asia Minor, on Lebanon and Antilebanon, rare on the higher mountains of Greece. Attempts might be made to cultivate this useful tree in the drier parts of the Panjab Himalaya. Hardy in England.

7. TAXUS, Tournef.

Slow-growing and long-lived evergreen trees or shrubs, with tough red heartwood. Leaves linear, distichous. Flowers sessile in the axils of leaves, usually dioicous. Male catkins subglobose, stipitate, supported at the base by empty bracts, the axis bearing at its end numerous peltate scales, each on its lower edge with 3-6 anther-cells, dehiscing longitudinally. Female flowers resembling leaf-buds, consisting of a few imbricate scales, enclosing an erect ovule, surrounded at the base by a disc which is membranous in flower, but enlarges into a red fleshy cup, surrounding the seed. Testa bony, embryo with 6-7 cotyledons.

1. **T. baccata**, Linn.; DC. Prodr. xvi. ii. 500; Hook. Stud. Fl. 349; Reichenb. Ic. Fl. Germ. t. 538.—Syn. *T. nucifera*, Wall. Tent. Fl. Nep. t. 44; *T. Wallichiana*, Zucc. *Yew*. *Eibe*, Germ.; *If*, Fr.; *Tasso*, It. Vern. *Sarāp*, *badar*, Afg.; *Birmi*, *barma*, *tūng*, *thūnu*, *sungal*, *püstül*, *chogu*, Kashmir, Chamba; *Rakhal*, Bias; *Barmi*, Shali; *Thūna*, Hattu; *Yamdal*, Kunawar; *Thūner*, *geli*, *gallu*, *lūst*, N.W.P.; *Nhare*, Tibet; *Tingschi*, Sikkim.

A large tree with dense, dark-green foliage. Leaves linear, 1 line broad and 1½ in. long, apex sharp, base narrowed into a short petiole, decurrent along the branch with two raised lines. Male flowers yellow. Fruit a red ovoid berry, somewhat more than ⅓ in. long, open at the mouth, so that the top of the dark olive-green seed appears.

Kafiristan, south side of the Safedkoh. Himalaya from the Indus to Bhutan, abundant in places, but very local. Not uncommon in Hazara, common in the dense forests of *A. Webbiana*, *A. Smithiana*, *Acer*, *Pavia*, *Juglans*, on the upper part of the northern slopes of the range stretching from the Shali to Narkanda, also on the sides of Hattu, both north and south, in the Balsan forests east of the Giri, opposite to Imbri, and in many other places between Sutlej and Ganges. In Kunawar it is found, here and there, above 9000 ft.—*e. g.*, above the Nachar forest, and in the Baspa valley. In Garhwal and Kamaon it is generally found between 6000 and 8500 ft., ascending to 11,200 ft. at Kedarnath. It grows in Sikkim, on the outer ranges at 9500 to 10,000 ft., in the inner ranges descending to 7000 ft. in Bhutan and on the Kasia hills (at 5000 ft.), and has been found in upper Burma. As defined by Parlatore, this species extends throughout Europe, North Africa, and is found on the mountains of Asia Minor, Armenia, and on the Caucasus; he enumerates 5 species besides, two from Japan and three from North America, which Hooker regards as all forms of the same species. In Central and North Europe the Yew is indigenous both in the plains and on the mountains, but in the Mediterranean region it is only found at a considerable elevation. In some regions of the Himalaya its lower limit is not exactly known; it does not extend into the inner arid zone. It is certain that the Yew was more common formerly in many forests of Central Europe than it is at present; the young plant requires shelter, and, like the Holly, thrives in deep shade. Any system of forest management, therefore, which requires entire or partial clearances, impedes its growth and prevents reproduction by self-sown seedlings. In the Himalaya the Yew clothes itself with young brilliant green shoots in April and May, and the flowers open between March and May. In Europe it flowers, according to latitude and elevation, between March and May, and the young shoots generally appear a week after flowering (Willkomm, Forstl. Fl. 223). The fruit ripens (in India and Europe) from Sept. to Nov. of the year of flowering.

In the Himalaya the Yew attains a considerable size; Madden records a tree at Gangūtri 100 ft. high and 15 ft. girth. In the Panjab Himalaya the common size is 5-6 ft. girth; in Hazara 8-9 ft. is not uncommon. In Europe the largest and oldest Yew-trees are recorded in Britain; specimens 10 ft. diam. and 30 ft. girth are not rare in England and Scotland, and some are on record with a diam. of 15-20 ft. The growth of the tree is slow; and there is no doubt, from an examination of the annual rings and from historical records, that some of the Yew-trees now in existence in England are considerably more than 1000 years old. The bark is thin, brownish-grey, hard and smooth, cleft longitudinally and peeling off; inner substance fibrous. The growth is very slow, 20-32 rings per in. of radius are recorded from the Himalaya, and this accords with the experience of the growth of the tree in Europe. Sapwood whitish, the heartwood is reddish-brown, compact, hard and heavy, 46-59 lb. per cub. ft. It is strong and elastic, and takes a beautiful polish. In Europe it is used for all kinds of turnery, for carving, and other purposes which require a firm and elastic wood. Whip-handles are made of the branches, and from time immemorial it has been the principal wood used for bows. The Indian wood, as far as known, has the same qualities as that of the European tree; bows, carrying-poles, and native furniture are made of it, but it might be more extensively used. The tree is held in great veneration in some parts of the N.W. Himalaya, it sometimes is called *Deodār* (God's tree); the wood is burnt for incense, branches are carried in religious processions in Kamaon, and in

Nepal the houses are decorated with the green twigs at religious festivals. The bark (*sang, sangha*) is exported to Ladak from Kunawar, to be mixed with tea, and to be used as a red dye. In Kunawar a decoction of it is administered for rheumatism. The branches are used to support earth roofs. The leaves (*birmi*) are exported to the plains of the Panjab, and used medicinally as a stomachic; in Europe they are considered poisonous, but not everywhere nor under all circumstances. Goats, rabbits, and sheep eat them freely (Selby, Brit. Forest Trees, 374). The berries are sweet and harmless, and are eaten by the natives of the N.W. Himalaya.

Podocarpus neriifolia, Don; DC. Prodr. xvi. ii. 514, is a large evergreen tree with somewhat whorled branches and alternate, coriaceous, linear-lanceolate leaves with a prominent midrib, 4-5 in. long; male catkins axillary, cylindric, antheriferous scales with 2 anther-cells; fruit axillary, fleshy, 1-seeded, ovoid, on a fleshy receptacle.

Nepal, Sikkim, Kasia, ascending to 3000 ft. A remarkable tree in Burma, nearly allied to it, which S. Kurz, however, refers to *P. bracteata*, Blume, of the Indian Archipelago, grows in the evergreen forests of the Bithoko range, between the Yunzaleen and Salween rivers, above 2000 ft., where I found it in March 1859, also on the coast-range of the Tenasserim provinces. It is called *Thit min, the Prince of trees*, in Burma. The wood is close-grained and highly prized in Burma.

ORDER LXXVII. PALMÆ.

Stem solid, either an underground perennial rhizome, producing flower-stalks and tufts of leaves, or more commonly above ground, erect, scandent or supported by other trees and bushes. The stem above ground is, with few exceptions, simple and without leaf-bearing side branches. The vascular bundles do not unite into concentric masses of wood and bark, separated by a continuous cambium layer, but are distinct, scattered in the cellular tissue of the trunk. They consist of vessels, varying in size, which on a horizontal section appear as pores; secondly, of elongated or polygonous cells, generally forming a mass of softer tissue, immediately surrounding the vessels; and, thirdly, of a mass of long thick-walled bast-cells or fibres, of which the hard horny portion of the bundle is composed. Near the circumference the bundles are generally more numerous, smaller and harder, owing to the predominance in them of the bast-cells or fibres, while near the centre they are sparse, containing a relatively larger proportion of cells and vessels. The result is, that the centre of a Palm stem is generally the softest part, not rarely becoming hollow by the decay of the cellular tissue. The vascular bundles can be traced from the interior of the stem to the base of the leaf, which is generally broad, and in most cases cylindric and sheathing. The youngest leaf in the terminal bud is at the top in the centre; as the bud expands it enlarges, and at last encloses the circumference of the stem, hence the vascular bundles descending from it bend inward towards the centre. Lower down these same bundles gradually bend outward toward the circumference, where they can be traced for a considerable length in a vertical direction under the surface. This explains a remarkable feature in the structure of the Palm stem, which shows itself most distinctly in a vertical section made parallel to the radius, but may also be observed in a horizontal section. In vertical sections a portion of the vascular bundles will be found to run straight downward, but they are crossed by other bundles at oblique angles. The latter are those portions which bend outward towards the base of the leaf or the lower part of the stem. In transverse sections some bundles may generally be noticed, cut through in a slanting, not horizontal direction; these were cut across in their outward course towards the circumference of the tree. Again, the structure of each bundle is different in its upper and lower part: in its upper part it contains all three classes of elementary organs enumerated above, vessels, fibres, and cells; whereas the lower part is almost entirely composed of fibres. This will explain the different composition of the vascular bundles near the centre, and the circumference of the stem. The stem of many Palms has a distinct rind composed of thick-walled cells, and inside of it the outer vascular bundles (consisting mainly of thick-walled fibres) are sometimes nearly confluent, but never entirely so. But though the outer stratum is harder, there is no distinct bark that can be stripped off, and no continuous confluent cambium layer as in Dicotyledons and Conifers. Nor are there any annual rings in the wood of Palms. After the stem has once attained a certain size, it does not materially increase in thickness, though it sometimes swells out in an irregular manner.

As regards the surface, one group of Palms has smooth and shining stems, annulate with raised rings, which are not quite horizontal, but slightly and alternately inclined to opposite sides. These rings are the scars of fallen leaves, and according to the length of the joint or internode, they are at greater or less distances from each other. The *Rattans* (*Calamus*) and the *Betel Palm* (*Areca*) are instances of this group. In another group (*Chamærops*, *Borassus*, *Cocos*, *Phœnix*) the surface of the stem is rough with the persistent base of the petioles, and in this group the internodes are always short, and the leaves and scars of petioles are arranged around the stem in a series of close spirals. It will be readily understood that in the Palms of the second class the leaves always stand close together, forming a dense tuft at the end of the stem, while in those of the first group the leaves stand at some distance, often covering a considerable length of the stem (*Calamus*).

The leaves of seedlings are always undivided; those which are formed at a later period are generally either pinnately or palmately divided, the pinnæ or segments being linear or lanceolate, mostly folded longitudinally with numerous and parallel nerves. The segments of palmatifid leaves are frequently bifid, those of pinnately divided leaves are either entire or irregularly lobed (*Wallichia*, *Caryota*, and allied genera), and in that case the edge or outline of the leaf runs partly with the nerves, partly across at an oblique angle, a portion of the outline appearing dentate by the projecting ends of the nerves. The petiole is always broad-based, and generally amplexicaul or sheathing.

The inflorescence is terminal in some Palms (*Corypha*, *Metroxylon*), but lateral in most cases, either in the axils of existing or fallen leaves. It is generally a panicle enclosed in bud by large sheathing bracts (spathes), the common peduncle (spadix) being often branching, thick, and sometimes woody. The flowers are rarely bisexual, generally dioicous, monoicous, or polygamous. Calyx and corolla, as a rule, consist of 3 segments or leaves each, those of the fertile flowers are commonly persistent in fruit. Stamens 6, rarely 3, 9, or numerous; anthers 2-celled, opening longitudinally. Ovary 3-celled, one ovule in each cell; sometimes 3 distinct 1-celled carpels. Seed albuminous; albumen cartilaginous, horny, or oily. Embryo small, cylindric, when germinating the upper end remains enclosed in the seed, enlarging considerably at the expense of the albumen, while the lower part lengthens out, throwing out lateral rootlets, and at a greater or less distance from the seed, the plumula emerges from the slit, bearing one or two truncate sheaths, which surround the undivided leaves of the seedling.—Royle Ill. 394; Martius, Historia Naturalis Palmarum, folio, vol. i.-iii., 1823-1850. Griffith, The Palms of British India in the Calcutta Journal of Natural History, vol. v., 1845, and (with plates and additions) in folio in the Posthumous Papers: Calcutta, 1850.

This Family, which comprises upwards of 680 species, is commonly divided into the following six Tribes:—

Borassineæ.—Leaves fan-shaped; flowers unisexual, commonly dioicous; male flowers in the axils of whorled closely imbricate bracts, in thick cylindric spikes; albumen horny or cartilaginous—*Borassus, Hyphæne, Lodoicea.*

Coryphineæ.—Leaves fan-shaped, base of petiole broad-based or sheathing, sheath fibrous; flowers bisexual or polygamous, in compound panicles; carpels 3, distinct or cohering; albumen horny—*Chamærops, Corypha.*

Phœnicineæ.—Leaves pinnate, leaflets entire, petiole on a short reticulate fibrous sheath; flowers dioicous, in long spikes at the end of a compressed, often woody peduncle; carpels 3; fruit fleshy, 1-seeded, enclosing a hard seed with bony albumen—*Phœnix.*

Arecineæ.—Leaves pinnate, leaflets entire or jagged; petioles sheathing; flowers monoicous, inflorescence of long drooping spikes at the end of a thick, almost fleshy peduncle; seeds hard with horny albumen —*Wallichia, Caryota, Areca, Ceroxylon, Arenga.*

Cocoineæ.—Leaves pinnate, leaflets entire, petioles amplexicaul, with a fibrous base; flowers monoicous, inflorescence of long drooping spikes at the end of a thick sometimes branched peduncle; albumen oily or cartilaginous—*Cocos, Elæis.*

Lepidocaryineæ.—Leaves pinnate, leaflets entire, petioles on long sheaths, petioles and sheaths with prickles, scattered or in oblique lines or rings; flowers monoicous or dioicous, in compound panicles, with sheathing bracts at the ramifications, common peduncle, petiole or sheath often terminating in long thorny whip-like thongs; ovary 3-celled; fruit covered with closely adpressed, imbricate, recurved scales; albumen horny—*Calamus, Metroxylon, Sagus.*

Leaves fan-shaped.
  Flowers dioicous, in paniculate spikes; male spikes thick, cylindrical, flowers fasciculate in the axils of broad whorled imbricate connate bracts, ovary 3-celled . 1. BORASSUS.
  Flowers polygamous, in compound panicles without bracts; carpels 3, distinct . . . . 2. CHAMÆROPS.
Leaves pinnate or pinnatifid.
  Pinnæ cut and jagged, often cuneate . . . . . 3. WALLICHIA.
  Pinnæ linear or lanceolate, entire.
    Leaves terminal.
      Flowers dioicous; fruit fleshy, enclosing a hard seed with bony albumen . . . . 4. PHŒNIX.
      Flowers monoicous; pericarp fibrous, endocarp hard, bony, albumen oily . . . . 5. COCOS.
    Leaves distant, lateral, on long thorny sheaths; flowers in long panicles with sheathing bracts . . . 6. CALAMUS.

1. BORASSUS, Linn.

Stem tall cylindric, with a large terminal crown of fan-shaped leaves. Petiole semiterete, broad-based, edges serrate, with hard horny spinescent serratures. Flowers dioicous, spadix with few simple branches, lower part covered with numerous large sheathing coriaceous and fibrous imbricate bracts. Male inflorescence composed of thick cylindric spikes, in pairs or in threes at the ends of the branches of the spadix. Axis thick, cylindric, covered with numerous broad whorled closely set and imbricate bracts, connate at the edges, each bearing in its axil a fascicle of 10-12 flowers and numerous membranous bracts, the flowers concealed in bud, but becoming exserted on expansion by the lengthening out of the corolla tube. Calyx campanulate, trifid to the middle; segments narrow-oblong or linear. Corolla a slender solid tube, which, lengthening out, rises above the bract, and expands into a 3-partite limb, with oval concave segments. Stamens 6, inserted on the solid corolla tube; filaments short; anthers sagittate; no rudiment of ovary. Female spikes paniculate, with numerous annular sheathing bracts, each flower consisting of 8-12 unequal, closely imbricate, rounded coriaceous concave leaves (bracts sepals and petals), all similar in shape and texture. Ovary 3-celled, surrounded by 6-9 small sterile stamens; stigma sessile. Fruit enclosed by the enlarged and partly fleshy closely imbricate perianth and bracts, 3-seeded. Albumen horny.

1. **B. flabelliformis**, Linn.; Roxb. Cor. Pl. t. 71, 72; Fl. Ind. 790. *The Palmyra Tree.*—Sans. *Trinarâja* (king of grasses). Vern. *Tāl*, *tāla*, *tār*, Hind.; *Potu tādi*, the male, *penti tāti chettu*, the female tree, Telugu; *Htanben*, Burm.

Young stems covered all their length with the dry leaves or lower part of petioles, old stems marked with the hard black long and narrow scars of the fallen petioles. Base of stem surrounded by a dense mass of numerous long cylindrical rootlets, consisting of a tough central vascular axis surrounded by a mass of fibres and a layer of thin brittle bark. Segments of leaves 60-80, parchment-like, smooth, shining, folded along the midrib, linear-lanceolate, connate to half their length, entire, at last bifid, 18-30 in. long, diameter of the leaf 3-5 ft.; petiole 2-4 ft. long. Male spikes drooping, flowers delicate, pink and yellow, one flower only opening at a time in each bract. Fruit subglobose, depressed, 5-7 in. diam., smooth, shining, dark brown shaded with yellow, rind coriaceous, enclosing a yellow pulp mixed with tough straw-coloured fibres, which surround the seeds. Seeds 2-4, generally 3, broad, heart-shaped; albumen white, cartilaginous.

Cultivated in the Indian Archipelago, the trans-Gangetic peninsula, Ceylon, South and Central India, Bengal, and Lower Sindh. In North-West India as far north as Alligarh and Shahjehanpur. Isolated trees in gardens in Rohilkhand and the Upper Ganges Doab as far as Saharanpur. Also on both sides of the Persian Gulf, attaining there about the same latitude as in North-West India—30° N.L. Fl. March; the fruit ripens in April or May. Generally 40-60 ft. high, but attains 100 ft. in Burma (in the splendid Palmyra groves of the Prome district), and perhaps elsewhere. Forked and branching stems are occasionally found. Diam. of a full-grown tree above the generally thick base, about 18-24 inches. The heart of the tree is soft, but the outer wood is hard, heavy, and durable, consisting of numerous thick black vascular bundles. Weight, 65 lb.; value of P. 944, Skinner. The stems are hollowed out and employed as water-pipes; cut half through lengthwise they serve as gutters and open channels. The outer wood is used for posts, rafters, and building generally, also for furniture. The leaves are, like those of *Corypha*, universally employed for writing upon (with a pointed iron style); documents written on Palm-leaves last several centuries; the leaves are also used as thatch and for mats and basket-work. The pulp of the fruit is eaten, raw or roasted, and a preserve is made of it in Ceylon. The unripe seeds, and particularly the young plants 2-3 months old, are an important article of food. But the most valuable produce of the tree is the sweet sap which runs from the peduncles cut before flowering, and collected in Bamboo tubes or in earthen pots tied to the cut peduncle. Nearly all the sugar made in Burma, and a large proportion of the sugar made in South India and the Konkan, is the produce of this Palm. The sap is also fermented into toddy and distilled.

To the same genus belongs the *Deleb Palm*, *Borassus Æthiopum*, Mart., a common tree in a large tract of tropical Africa south of the Sahara, from Timbuktu to the Nile, and from Lake Tchad to the Nyassa Lake. The fruit, but still more the young seedlings, which are raised on a large scale for that purpose, are important as an article of food. Two other remarkable Palms are classed under the tribe of *Borassineæ*: 1. *Lodoicea Sechellarum*, Labill.; Bot. Mag. t. 2734-38, the *Coco de Mer*, *Double Cocoa-Nut*. A tall Palm with distinctly annulated stem, crowned with a tuft of 12-20 gigantic leaves, folded up when young like a shut fan, expanding afterwards into a broadly ovate blade, numerous lateral ribs diverging from a prominent midrib at acute angles, the edges more or less deeply cut; petiole as long as leaf. The flowers are dioicous, and similar to those of *Borassus*; the male flowers, however, have 15-20 monadelphous stamens. The fruit takes several years to come to maturity. It attains a gigantic size; the weight of the ripe fruit is often 40-50 lb., and consists of a thick fibrous rind, enclosing 1, sometimes 2 or 3, hard nuts, which are 2-lobed, sometimes 6-lobed. When ripe the albumen of the seed is horny, but when unripe the inside of the fruit is soft and eatable. The unripe fruit is eaten, and the hard black shell of the nut is carved into ornaments, and Fakirs' drinking-cups. The leaves when young yield a beautiful material for basket and plaited work; hats, fans, and various other articles are made of them; when full-grown they are used for partitions and roofs of houses. This Palm is only found on two or three small rocky islands of the Seychelle group north-east of Madagascar. These islands were discovered in 1749, but long before that time the double Cocoa-nut had been known in India, and on the Indian Archipelago, having been washed upon the Maldive Islands by the monsoon, and the tree being unknown, wonderful stories were current regarding the nature and origin of these curiously-shaped nuts. 2. *Hyphæne thebaica*, Mart.; Hist. Nat. Palm. t. 131, 132, 133, the *Doum Palm* of Upper Egypt and Nubia, extending west to the Niger near Timbuktu, one of the few species of this Order, the stem of which habitually and normally divides into bifurcating branches, each branch bearing a crown of fan-shaped leaves. The flowers are dioicous; the fruit is in long hanging clusters, irregularly shaped, surface shining brown, 1-seeded, with a sweet fibrous mealy rind which has a taste like gingerbread—is eaten, and forms an important article of food in some parts of Africa. Rosary-beads are made of the horny albumen.

2. CHAMÆROPS, Linn.

Stems densely covered while young with the lower parts of petioles. Base of old stems indistinctly annulate. Leaves fan-shaped, forming a rounded terminal crown; petioles sheathing, the sheath fibrous, edges of petioles mostly aculeate. Flowers yellow, polygamous, often dioicous, inflorescence a compound panicle on a thick peduncle (spadix), enclosed in bud by a coriaceous oblique sheath. Calyx tripartite, corolla of 3 petals, valvate in bud, petals and calyx-segments often more numerous. Stamens 6-9. Carpels 3, distinct. Berries 3, or fewer by abortion. Albumen horny or cartilaginous; embryo dorsal.

1. **C. Martiana**, Wall. Pl. As. rar. t. 211.—Syn. *C. Khasyana*, Madden, On the occurrence of Palms and Bamboos at considerable elevations in the Himalaya, Trans. Edin. Bot. Soc. iv. 186 (1853). Vern. *Jhangra, jhaggar, tal*, Kamaon; *Taggu*, the Newar name in Nepal.

A tall slender tree, 40-50 ft. high, stunted on dry ground or in otherwise unfavourable localities, with a globose crown of dark shining leaves. Petioles 3 ft. long, the sheathing base consisting of 2 layers, the inner layer, which separates from the outer, being composed of a network of brown tough fibres, crossing each other at oblique angles, forming a close network of rhomboid meshes; upper part of petiole half-round, woolly, edges slightly denticulate. Blade orbicular, consisting of 30-40 linear segments 15-20 in. long, connate to one-third or one-half their length, emarginate or shortly bifid at the top. Inflorescence a drooping compound panicle covered with dark rust-coloured down, with several stout main branches, each in the axil of a large coriaceous sheathing bract. Petals three times longer than calyx, ovate, concave, whitish. Stamens 6, filaments subulate, nearly free, longer than anthers. Ovaries and rudiment of ovary hairy. Berry 1, oblong, yellow at first, dark glossy blue when ripe. In Wallich's figure, and Martius' description which accompanies it, the fruit is yellow, probably because unripe.

Grows in great numbers, forming clumps and rows, on the Thakil Mountain in eastern Kamaon, in the fork between the Sarju and Kali rivers, between 6500 and 7800 ft., where snow generally covers the ground from Nov. till March, above the zone of *Pinus longifolia* in the region of *Quercus*, *Rhododendron*, *Andromeda*, and *Taxus*, in damp shady glens on the north and south-east, but chiefly on the north-west side. Also on Dhuj Mountain, north-east of the Thakil, on the Kalimoandi range between the Ramgunga and Gori rivers, and in the Sarju valley near Bagesar. Dwarf specimens were found by Madden in two localities of north-west Kamaon—viz., at the base of the Satbūnga Mountain, south-east of the Gagar Pass, in very dense forest at 6500 ft. elevation, and on the Berchula, a spur of the Bhatkot Mountain, considerably farther in the interior, and at about 8000 ft. elevation, which probably is its western limit. Also in great abundance at Bunipa in the great Nepal valley 5000 ft. elevation (Wallich). Fl. April, May; fr. Oct. The fruit is eaten, though the pulp is scanty and almost tasteless.

C. khasyana, Griff.; Calcutta Journ. Nat. Hist. v. 341, on precipices at Mūsmai and Mamlū, Kasia, alt. 4000 ft.—Vern. *Pakha*, Hook. Him. Journ. ii. 279—is described as a distinct species, differing by the petioles toothed throughout, the nature of the fibrous net of the petiole sheaths, and the thick white paleaceous tomentum with which the young leaves are covered. The fruit is blue when ripe, like that of *C. Martiana*, and both Madden and Hooker have suggested the identity of the two. In Griffith's posthumous work (Palms of British India, 134), Thakil in Kamaon is given as a locality of *C. khasyana*. In Voigt's Hort. Suburb. Calc. 641, the Kasia Palm is mentioned as cultivated in the Calcutta gardens (without having flowered) under the name of *C. Griffithiana*, Wall. MSS. In the Revue Horticole of 1870, 276, *C. Griffithii*, Lodd, is described and figured as a Palm 10 ft. high, petiole unarmed, without serratures, but white-tomentose when young; received at Paris in 1839 from Dr Wallich in Calcutta. This probably is *C. Martiana* of Nepal and Kamaon. The question whether the Kasia plant is a distinct species is a matter for farther inquiry. No *Chamærops* has yet been reported from Sikkim.

Hermann Wendland, as quoted by Gay (*Chamærops excelsa*, Thunb. in Bulletin de la Société Botanique de France, 1861), classes the two species mentioned, together with *C. excelsa*, Thunb., of Japan and North China, under a new genus, *Trachycarpus*, distinguished from *Chamærops* by an elongated inflorescence, subulate filaments, hairy ovaries; the embryo dorsal, but situated above the middle; whereas in *C. humilis*, and allied species of *Chamærops* proper, the embryo is situated near the base of the back, the ovaries are glabrous, and the filaments short, broad, and connate at the base. *C. excelsa* is a most useful plant; the leaves are made into hats and waterproof cloaks, and rope is manufactured of the inner fibrous layer of the sheath.

C. humilis, Linn., is a widely spread Palm, with small semicircular leaves of 20-30 segments, of the western Mediterranean region and North Africa, its northernmost limit being the Riviera near Nice, N.L. 43°. In Spain it covers large extents of waste land, and is sometimes found difficult to eradicate, on account of its deep and tough roots. Mats and baskets are made of the leaves, and they have of late years been employed to make paper. The hard horny ruminated albumen of the seed is made into rosary-beads.

2. **C. Ritchieana**, Griff. Calc. Journ. Nat. Hist. v. 342.—*Mazri*. Vern. *Mzarāi*, trans-Indus (*maizurrye*, Pushtu, Griff.); *Kilu*, *kaliūn*, Salt range. The fibre is called *patha* in the Panjab. *Pfīs*, *pesh*, *pease*, *fease*, *pfarra*, *pharra*, Sindh, Beluchistan.

A low gregarious shrub with greyish-green coriaceous leaves. Petioles entire and unarmed, 6-12 in. long, base without any reticulate inner layer, but with a mass of rust-coloured wool. Segments 8-15, linear, rigid, 12-15 in. long, induplicate, deeply bipartite. Inflorescence erect, a slender compound panicle, branches and branchlets from the axils of tubular membranous sheathing bracts with prominent reticulate longitudinal nerves; branchlets bifarious, with numerous flowers in the axils of turbinate membranous sheathing bracts, with a thin membranous edge. All the bracts are closed sheaths, with a short subulate or triangular apex; they are spirally arranged, though apparently distichous on the principal axis and the main branches. Male (bisexual ?) flowers enclosed, while in bud, in the sheathing bracts, and supported by a hyaline 2-nerved, and bicuspidate bracteole (similar to the palea of grasses). Calyx gamosepalous, thin, hyaline, 3-dentate; petals 3, oblong obtuse; stamens 6, and a glabrous conical, syncarpous rudimentary (?) ovary. Anthers sagittate, attached at the back above the base to the subulate filaments. Fruit an ovoid or subglobose 1-seeded berry, with the rudiments of 2 abortive carpels, supported by the marcescent calyx, petals, and the remains of the 6 filaments. Fruit subglobose or oblong, varying in size, from ¼ to ½ in. diam., surface minutely wrinkled. Albumen horny, with a large central cavity. Embryo basal.

This species is altogether unlike a *Chamærops*, and will eventually form a new genus, the inflorescence, bracts, and 2-nerved bracteoles resembling those of some species of *Calamus*. The materials available (unripe fruit and young buds of male or possibly bisexual flowers) do not admit of establishing the generic characters in a satisfactory manner at present. This interesting Palm is recommended to the attention of botanists who may visit its native habitat.

Abundant in the Peshawar valley, in Kohat, and in the trans-Indus territory along the eastern skirts of the Sulimān range, ascending to 3000 ft.; also on the hills which form the western boundary of Sindh. Common locally on a limited area in the central Salt range, between 2500 and 5000 ft., and on Mount Sakesar. Also found by Dr Stewart in one place in the Siwalik tract east of the Jhelam, near Sumāni above Bhimbur. Common in the Khaiber Pass, and generally in the low arid mountains of eastern Afghanistan. Everywhere up to 5000 ft. in Beluchistan and Mekran, except near the coast. The fruit ripens in summer. It is generally stemless, the tufts of leaves arising from a creeping underground rhizome, and in this shape it covers large tracts of rough rocky ground. But a stem grows up sometimes; in Sindh Stocks notes it 6-8 ft. high, and Dr Stewart records a specimen planted in the Saharanpur garden, from seed brought by Dr Jameson from Kohat more than twenty years ago, with a trunk 10-12 ft. high. It is a most useful plant in the arid regions where it is common. The stems, petioles, and leaves serve as fuel, the delicate young leaves are eaten as a vegetable, the reddish-brown moss-like wool of the petioles is impregnated with saltpetre (steeped in the juice of Mulberry-leaves, Bellew), and used as tinder for matchlocks. Excellent matting is made of the leaves (superior to that made of *Phœnix*, Aitchison). Rope is also made of leaves and leaf-stalks; at the Jhelam bridge of boats it was used one season, when *mūnj* (*Saccharum Sara*) was scarce, but Dr Stewart records that it snapped with a strain which it is supposed *mūnj* would have resisted. The leaves are also made into fans, sandals, baskets, pouches, brushes. Trans-Indus, a rude kind of drinking-cup is made of the entire blade, by tying together the tops of the segments. The seeds are pierced, made into rosaries, and are exported for that purpose to Mekka *via* Muscat, from Gwādur on the Beluchistan coast west of the Indus.

Corypha umbraculifera, Linn. Roxb. Fl. Ind. ii. 177, *the Talipat Palm* of Ceylon and the Malabar coast, has bisexual hexandrous flowers in a large erect compound pyramidal panicle, which is terminal in the centre of the crown of leaves, and as tall as the trunk of the tree. After the seeds ripen the vegetation of the terminal shoot is completed, and the tree dies. The leaves are nearly orbicular, with a diameter of 10 ft., segments 40-50, united beyond the middle, and bifid. Fans, mats, and umbrellas are made of the leaves, and the segments of this as well as of a closely allied species, *C. Taliera,* Roxb. Cor. Pl. t. 255, 256—Sans. *Tali;* Vern. *Tara,* Beng.—which grows in Bengal, are used for writing, like the leaves of *Borassus,* and books of these leaves last for centuries. There is a third species, *C. elata,* Roxb. Fl. Ind. ii. 176—Vern. *Bajūr,* Beng., also a native of Bengal, trunk 60-70 ft. high, and inflorescence one-fourth the length of the trunk. Roxburgh records that two trees of this species at Calcutta came into flower when about thirty years old. The two Bengal species flower in March and April, the seed ripening 8-9 months afterwards. The albumen of *Corypha* is horny.

3. WALLICHIA, Roxb.

Cæspitose shrubs, generally monoicous, with tufts of leaves or slender reed-like stems, from an underground rhizome. Leaves pinnatifid, petioles with short fibrous sheaths; pinnæ white beneath, lanceolate or cuneate, sinuate or lobed, alternate, the upper generally broader and confluent, the lower often subopposite and fasciculate; lateral nerves fine, numerous, separating at oblique angles from the prominent midrib, and terminating in unequal subulate teeth, where they do not run parallel to the edge of the leaf. Male and female flowers in distinct inflorescences, enclosed in bud by numerous imbricate sheaths. Calyx of male flowers gamosepalous, stamens 6 (subgenus *Harina*), or 3 sepalous, stamens numerous (subgenus *Orania*). No rudiment of ovary. Calyx and corolla of female flower deeply 3-partite, generally coriaceous. Ovary 2-celled. Fruit fleshy, with acrid juice, 2-seeded or (by abortion) 1-seeded; albumen uniform, horny, embryo in the convex part (back) of the seed.

1. **W. densiflora,** Martius; Bot. Mag. t. 4584.—Syn. *Harina oblongifolia,* Griffith Palms, t. 237, A.B.C. Vern. *Kala Aunsa* (black reed), *gor aunsa,* Kamaon. *Ooh* (*ūh*) of the Lepchas in Sikkim.

A stemless palm, forming thick tufts of large leaves 10 ft. long or more, which die to the ground after the fruit ripens. Petiole angular, naked in the lower half or two-fifths of its length, the edges separating into black fibres covered with dark-brown scurf; pinnæ linear-lanceolate, 9-18 in. long. Male flowers nearly white, crowded, in numerous densely packed spikes, which form a compact drooping, ovoid panicle, enclosed before flowering in large ovate, imbricated, dark-purple sheaths, streaked with yellow. Calyx tubular, truncate, 2 lines long; petals linear, twice the length of calyx, connate at the base with each other and the stamens into a short fleshy stalk. Stamens as long as petals. Female flowers in rigid spreading spikes, forming an erect panicle. Fruit crowded in erect spikes, ovoid-oblong, brown and purple, supported at the base by the persistent coriaceous perianth; pulp scanty, with a mucilaginous acrid juice; seeds 2, plano-convex.

Hills east of Chittagong, Kasia hills, ascending to 4000 ft. Assam, Sikkim, up the Teesta valley to Chakūng, at 4400 ft., growing side by side with the birch, willow, alder, and walnut (probably this species, Hook. Him. Journ. ii. 18). Kamaon, in shady and moist valleys, ascending to 3500, and at times to 4000 ft., forming extensive thickets in the valleys of the Kali and Sarju. Bamauri Pass, below Naini Tal, and in the Patli Dun, which seems to be its north-west limit. Fl. May, July. In Kamaon the leaves are used as thatch, and are said to be imperishable. *W. caryotoides*, Roxb. Cor. Pl. t. 295—Syn. *Harina caryotoides*, Ham.; Griff. Palms, p. 174, differs by cuneate pinnæ, and narrower ovate-lanceolate sheaths of the male inflorescence. Roxburgh's plate gives the calyx of the male flower subglobose, but the description makes it cylindric. Chittagong, where, according to Roxb., it is called *Chilpatta* or *Belpatta.* Dense evergreen forest in the Rangoon district of Pegu (Pounglin, Bonee, *Zanūngben*). Tab. 237, in Griffith's Palms, marked *H. caryotoides*, is evidently intended for *H. oblongifolia.*

Nearly allied is *Caryota urens*, Linn.; Roxb. Fl. Ind. iii. 624; Mart. Hist. Nat. Palm. t. 107; Griff. Palms, p. 169—the *Mhār Palm* of Western India. A splendid tree with a smooth annulate stem, large bipinnate leaves 18-20 ft. long, 10-12 ft. broad, petioles sheathing, nearly amplexicaul, panicles wedge-shaped, the lateral nerves terminating, as in *Wallichia*, in numerous short subulate teeth. Flowers monoicous, the male and female flowers on the same inflorescence, one female between two larger male flowers. Inflorescence long, hanging, 10 ft. long and more, consisting of a thick cylindric peduncle (spadix), surrounded at its base by numerous imbricate sheaths, and bearing at its end numerous slender simple pendulous spikes. Calyx and corolla coriaceous, anthers numerous, on short monadelphous filaments. No rudiment of ovary. Fruit with a thin acrid pulp, producing a burning sensation on the tongue, whence the name, 2-seeded, or 1-seeded by abortion; seeds compressed, oblong, ½ in. long, albumen horny, ruminate, with black simple lines. Embryo at the back of the seed. Evergreen forests of the Western Ghats, extending north to the Sattara district. Also in Ceylon and eastern Bengal, ascending to nearly 5000 ft. in Sikkim (Hook. Him. Journ. i. 143), Burma (*Mimboben*). The centre of the stem is generally soft, the cells being filled with a Sago-like farina (starch), which is made into bread, and eaten as gruel. The outer part is heavy and hard, with numerous firm, black vascular bundles, which are closely packed, but not confluent near the circumference, it is strong and durable, and is much used for building and agricultural implements. The fibres of the sheathing petioles, and of the peduncle (spadix), are made into rope and fishing-lines, which are said to be indestructible. But the main value of this Palm consists in the abundance of sweet sap which is obtained (as in *Cocos* and *Borassus*) from the cut spadix, and which is either fermented or boiled down into syrup and sugar.

Allied to *Caryota urens* is *Arenga saccharifera*, Labill.; Griff. Calc. Journ. v. 472; Palms, t. 235 A.—Syn. *Saguerus Rumphii*, Roxb. Fl. Ind. iii. 626—30-40 ft. high, with long leaves, 15-25 ft. long, 10 ft. broad, petioles sheathing, with a network of black horsehair-like fibres, which surround the stem, and are used for cordage; pinnæ fasciculate, linear, dentate, and jagged at the apex with numerous longitudinal nerves, white underneath. Fruit 2 in. long, fleshy, yellow when ripe, 3-seeded, pulp very acrid. The heart of the stem contains large quantities of Sago, and the cut flower-stalks yield a sugary sap, of which sugar and palm wine is made. Malay Peninsula, Indian Archipelago. Said to grow on the hills of Orissa, Hook. & Thomson Fl. Ind. 142.

To another subdivision of the same tribe (*Arecineæ*) belongs the *Areca Palm* —Sans. *Guvaka:* Vern. *Supari: Areca Catechu,* Linn. Roxb. Cor. Pl. t. 75; Fl. Ind. iii. 615; the *Betel Palm*—a tall slender annulate stem, attaining 80 ft. and more, with a diam. of only 12-15 in. Leaves pinnatifid, petiole on a long smooth green sheath, pinnæ linear-oblong, with a broad base and numerous parallel basal nerves, several of which are more prominent. Flowers monoicous, male and female on the same inflorescence. Peduncle thick fleshy, erect, from lateral buds below the lowest leaf, branching, the branches bearing solitary female flowers and numerous slender spikes, thickly set with fragrant male flowers. Stamens 6, on short broad filaments, surrounding a rudimentary ovary. Sepals and petals of female flowers imbricate, ovary 3-celled, surrounded by 6 sterile stamens. Fruit orange-coloured, ovoid, 2-2½ in. long, supported by the persistent coriaceous calyx and corolla. Pericarp fibrous, 1-celled. Seed depressed-conical, obtuse, 1 in. diam. or less; albumen horny, ruminated with numerous dark-brown or black curly radial lines; embryo basal. Cultivated throughout the Indian Archipelago, in Ceylon, the west side of India, below and above Ghat, in Burma, Siam, Cochin-China, Bengal, Silhet. Believed to be originally a native of the Sunda islands. The use of the seed for chewing with lime and the leaves of *Piper Betel* in India, the countries of the trans-Gangetic Peninsula, the Indian Archipelago and China, is well known. The finest groves of the Betel Palm which I have seen are in British Burma, on the hills between the Sitang and Salween rivers, and in the valleys drained by the feeders of the Yoonzaleen and Beeling rivers, and the Thoukyeghat and other tributaries of the Sitang. In the valleys of these hills are flourishing Betel Palm gardens to an elevation of nearly 3000 ft. Large quantities of Betel-nuts are brought down these rivers, and exported from Rangoon and Moulmein, and a grove of these Palms is a small fortune. For a new plantation the ground is trenched and prepared with the greatest care; long irrigation channels, winding along the sinuosities of the hills, bring the needful water to the spot; and the result is seen in large compact groves, which in dells and sheltered places sometimes attain an average height of 80 ft., or even more. Examples of flourishing Betel Palm groves in a comparatively dry climate are the plantations on the plateau of Mysore, below the great tanks, and irrigated by them. In Mysore, Canara, and Malabar, as in Burma, a fresh plantation is always made under the shelter of Plantains. In western India the Betel Palm is generally planted along with the Cocoa-nut, and often with Cardamoms. The soft but tough sheaths of the leaves are used in Burma and in western India to wrap up eatables, tobacco, and other articles; also as paper to write upon. Necklaces, the tops of walking-sticks, and other small objects, are turned of the seeds.

Ceroxylon andicola, Humboldt and Bonpland, Pl. Æquinoct. i. t. 1, also classed among *Arecineæ,* a tall elegant Palm with whitish stem, attaining 190 ft., is remarkable, because, like *Chamærops Martiana,* it grows at high elevations. Humboldt first discovered it at the foot of the snow-clad volcano of Tolima, on the Parama di Quindiu, the high pass which leads across the central Cordillera, from the Magdalena to the Cauca river. It has since been found by other travellers, particularly by Albert Berg, who has represented it towering over the forests of *Oak* and *Podocarpus,* in plates 5 and 6 of his admirable work, 'Tropical Vegetation of South America,' London, 1854. At an elevation between 6500 and 9700 ft. N.L. 4° 35″, it grows in abundance, associated with another alpine Palm, *Oreodoxa frigida,* Humb. et Kunth. The trunk is annulate, covered all over with a thin coating of a whitish substance, which is scraped off, mixed with tallow, and made into candles. It consists of vegetable wax, and a crystalline resin called *Ceroxylin.*

Another wax-yielding Palm, attaining 200 ft., is described by Karsten (Flora Columbiæ, i. t. 1), as *Klopstockia cerifera*, from the mountains in the vicinity of Caracas in Venezuela, at an elevation of 5000 ft. Vegetable wax is also obtained and used to make candles from the young leaves of *Copernicia cerifera*, the *Carnaba* wax-Palm of Brazil, which are coated with it. This Palm has fan-shaped leaves, and belongs to the tribe of *Coryphineæ.*

4. **PHŒNIX,** Linn.

Low shrubs or tall trees, the upper part of the stem closely covered by the bases of the petioles, the lower part rough with their scars, rarely annulate. Leaves pinnate, pinnæ entire, linear, rigid, folded longitudinally and attached obliquely with their folded base to the laterally-compressed petiole, the lowest pinnæ often transformed into spines. Petiole semiterete below the leaves, base a reticulate fibrous amplexicaul sheath. Flowers dioicous; a rigid, often woody axillary compressed peduncle, bearing near its upper end numerous long slender but rigid spikes, which are interrupted in the female, compact in the male inflorescence; peduncle enclosed in bud in a single thickly-coriaceous keeled sheath. Calyx cup-shaped, 3-toothed; petals 3, oblong and valvate in the male, ovate or rounded and imbricate in the female flowers. Male flowers: Stamens commonly 6, rarely 3 or 9, surrounding a rudimentary ovary. Female flowers: Carpels 3, distinct, with recurved styles. Fruit a single, generally oblong 1-seeded berry. Seeds with a longitudinal furrow. Albumen horny, embryo dorsal.

Tall trees; leaflets opposite or alternate, not fasciculate.	
Foot of stem often surrounded by root-suckers; leaflets making a very acute angle with the common petiole . .	1. *P. dactylifera.*
No root-suckers; leaflets making half a right angle with common petiole	2. *P. sylvestris.*
A low shrub with a bulbous stem, or a small tree with a slender stem; leaflets fasciculate	3. *P. acaulis.*

1. **P. dactylifera,** Linn.; Roxb. Fl. Ind. iii. 786.—Vern. *Khajūr, khaji.* The fruit: *Khūrma, chūhāra, kukyān, khujiyān, kujran.*

A tall tree, attaining 100-120 ft., trunk covered with the persistent bases of petioles, the foot often surrounded by a dense mass of root-suckers. Leaves grey, longer than those of *P. sylvestris;* pinnæ 8-16 in. long, regularly distichous, often approximate in twos or threes on the same side of petiole; petiole grey, laterally compressed, almost flat. Male panicles white, compact, 6-9 in. long, on a short peduncle; flowers $\frac{1}{4}$-$\frac{1}{3}$ in. long, sweet-scented; sheaths outside with rusty down. Peduncles of female inflorescence $\frac{1}{3}$-$\frac{1}{2}$ in. broad, sometimes broader below, spikes 12-24 in. long. Fruit oblong, 1-3 in. long, generally reddish- or yellowish-brown when ripe, pulp fleshy sweet. Numerous varieties cultivated, differing in colour, shape, and taste of the fruit. Seed cylindric, with a longitudinal furrow in front, and a small cylindric embryo in the middle of the rounded back. When the seed germinates, that end of the embryo which remains enclosed in the albumen enlarges at the expense of the albumen, the horny substance of which is converted into sugar and other soluble substances, which are absorbed by the embryo furnishing the substance for its early growth. The process is analogous to the conversion into sugar of the starch which fills the cells of the albumen of wheat, maize, rice, and bamboos, during germination, with this difference, that the starch forms the contents of the cells, whereas, in the stone of the date, the walls of the cells themselves furnish the food of the growing embryo.

In India the Date Palm is cultivated and self-sown in Sindh and in the southern Panjab, particularly near Multan and Muzaffargarh, also in the Sind Sagar Doab and trans-Indus territory. Near Dhera Ghazi Khan, Date Palms are very numerous on a strip 10 to 12 miles long from north to south. A few trees are found planted at many places in the eastern Panjab, also at Saharanpur, and here and there in the Ganges Doab and Bandelkhand. Is grown in the Dekkan and Guzerat, but does not thrive in Bengal. The tree was probably introduced into India at the time of the first Mahomedan conquest of Sindh, in the commencement of the eighth century. Its home is believed to be the lower part of the Euphrates and Tigris Doab, Arabia, Palestine, the Oases of the great African Sahara, and the eastern Canary Islands. It thrives luxuriantly in the arid rainless regions of North Africa and West Asia, where it is exposed to extreme heat in the day-time, and not uncommonly to frost at night, but it requires a certain amount of moisture in the soil. In Europe it is cultivated in Spain, where it was introduced by the Arabs, and where it produces eatable fruit; also on the Hyères islands, the Riviera near Nice, St Remo, and Genoa, where it attains its northernmost point at 44° 30′ N.L. There is a wood of Date Palms at Bordighera near St Remo, said to contain over 4000 stems, cultivated mainly to yield Palms for Palm Sunday at Rome. In South Italy, Sicily, and Greece, the tree is not uncommon, but the fruit is small and poor. On the island of Delos, Date Palms, sacred to Apollo, had been planted before Homer's time. In Syria and Palestine the cultivation of the Palm-tree is older than the first historical records in existence. On the south shores of the Caspian Sea the Date Palm was formerly cultivated to a large extent.

The tree flowers in March and April; male trees are generally less numerous than female trees, the female flowers are fertilised artificially. In Sindh (near Karachi), in Arabia, and elsewhere, this is done before the flower-sheaths open; a hole is made in the sheath of the female flower, and a few bits of the male panicle are inserted (Stocks in Hooker's Journ. of Bot. vii. 551). The fruit ripens Sept., Oct. Branching stems are occasionally found in the Panjab; it has been supposed (Stewart, Pb. Plants, 244) that these branches are merely apparent, caused by seeds germinating in the axils of the petioles; this view, however, is improbable. Many Palms have occasionally bifurcating stems, and sometimes develop a large number of side branches. A remarkable instance of a branched *Phœnix sylvestris*, in the Residency garden, Indore, with a trunk 22 ft. high to the first branch, and with 22 vertical closely-packed branches, is mentioned in the Gardeners' Chronicle of 1874, p. 116.

The wood of the Date Palm is lighter than that of *Cocos* and *Borassus*. The cellular tissue is soft; the vascular bundles generally show, on a horizontal section, an oval shape with two distinct large pores (vessels) at one end, the hard woody portion grey; on a vertical section, they appear as shining narrow lines. The wood of male trees and of trees past bearing is used for building, water-channels, bridges, and various other purposes. Of the leaves, mats and the bag-like baskets universally used in the whole Mediterranean region, and in other countries, are made. In the Panjab mats and fans are made of the leaves; they are called *Būtra* or *pattra* in Muzaffargarh, and *khūshab* in Shahpur. The petioles make excellent light walking-sticks, split up they furnish material for crates and baskets; the fibrous network, which forms the sheathing base of the petioles, is called *kabāl* or *khajūr ka bokla* in Muzaffargarh, pack-saddles for oxen are made of it, and the fibre separated is made into ropes. It is also known as *khajūr mūnj* (Powell, Pb. Products, 517). The fruit, however, is the most useful product of the tree; it furnishes, fresh or dried, the staple food of the inhabitants of Arabia, part of Syria, and the desert tracts of North Africa. In Sindh the Date is called *khūrma* when pulled ripe, and *chuwarar* when plucked before it is fully ripe, and boiled and dried in the sun. In the Panjab, Dates form an important article of food in certain districts, and they are sold in the bazar under different names, according to quality and the mode of preparation. Thus, according to Coldstream (Powell, Pb. Products, 268), the most esteemed kind is called *chirni* in the Muzaffargarh district; this is the Date of the best Palms, split up in the middle and dried in the sun. The second best is called *pind;* it is eaten as it comes from the tree, without farther preparation. The least esteemed kind is *būgri*, taken from inferior trees and boiled in oil and water. The Panjab Dates are smaller than those of Arabia or Egypt, but they are very good, and particularly so when there has been little or no late rain. When beginning to get ripe, a piece of matting is often put over the cluster of Dates to prevent birds eating them. The kernels are deemed medicinal. The large succulent head, cut from among the mass of leaves, is eaten—*gaddah*, Hind.; *gāri* or *galli* in Muzaffargarh. The tree yields a gum, called *hukm chil.* Attempts have been made, but without much success, to tap the Date-trees of Multan for their sugary sap (Stewart, Pb. Plants, 245).

2. **P. sylvestris**, Roxb. Fl. Ind. iii. 787; F. Hamilton in Trans. Linn. Soc. xv. 86; Griffith Calc. Journal of Nat. Hist. v. 350; Palms, t. 228, A. *Wild Date Palm.* Sans. *Kharjūra.* Vern. *Khajūr*, *khaji.* In the North-West Himalaya, *Salma*, *thalma*, *thakil.*

A tree, attaining 30-40 ft., stem rough with the prominent scars of fallen petioles, no root-suckers. Leaves greyish-green, 7-12 ft. long, pinnæ very numerous, 6-18 in. long, alternate and opposite, not fascicled; petiole compressed in the leaf-bearing part, brown at base. Inflorescence and flowers similar to those of *P. dactylifera*, peduncles of female flowers often 3-4 ft. long and 2-3 in. broad. Fruit oblong, about 1 in. long, green at first, reddish-yellow when ripe, pulp scanty, sweetish and astringent.

Indigenous in many parts of India, forms extensive forests in Rohilkhand, on the low ground along the Ramganga river, and on the plateau of Mysore between Shimoga and Tumkūr, in moister stretches of low ground which intersect and drain the rocky undulating granite hills. Not uncommon in the Siwalik tract and the outer Himalaya, often associated with *Pinus longifolia*, attaining 5000 ft. in Kamaon, with stems 40-50 ft. high (Madden, arborescent form of *P. humilis*). Ghiaunla in Garhwal at 3500 ft., 24-30 ft. high (Jacquemont). Banks of the Bias above Mandi (Cleghorn). In the Jamu hills at 2000 ft. elevation (T. Thomson, Him. Journ. 320). Salt range. Commonly planted and self-sown in most parts of India and Ceylon, except in Sindh and South Panjab, where *P. dactylifera* takes its place. Most abundant in Bengal, Behar, on the Coromandel coast, and in Guzerat. Fl. in March; the fruit ripening in Sept. and Oct. Mats and baskets are made of the leaves, but the chief product of the tree is the sugary juice, which is extracted during the cold season from Nov. to Feb. The lower leaves and their sheaths are removed, and a deep notch is cut into the trunk, which then bleeds for some time, a thin slice being taken off every day from the surface of the cut. When the bleeding stops the tree is allowed a short rest, after which it is cut again and begins to bleed afresh. In the ensuing year the tree is allowed rest, and in the third season a notch is cut on the opposite side of the trunk. This is the account given by Martin (Drury, Useful Plants of India, 340), and he adds that a tree is fit to be cut when ten years old, and continues to yield for about twenty years. The juice is either fermented or boiled down into sugar and molasses, and a large portion of the sugar made in Bengal, on the Coromandel coast, and in Guzerat, comes from this source. The wood of the *Khajūr* is lighter than that of *Borassus* and *Cocos*, 39 lb., value of P. 512 (Skinner). The vascular bundles are not black, but light-brown. It is used for building, water-tubes, and other purposes.

Roxburgh describes the leaves of *P. sylvestris* as standing in subopposite fascicles, pointing four ways. This to a certain extent is the case in young leaves and leaves of young trees, but on full-grown trees the leaflets are always distichous, opposite or alternate. Dalzell (Bombay Flora, 278), points out the mistake.

P. humilis, Royle, is probably synonymous with *P. sylvestris*. Madden, Journ. As. Soc. xviii. 629, states that at Almora the fruit ripens in July and is then of a black purple colour, sweet, and eaten ; and that on warm aspects and in a dwarfed state it reaches 7000 ft. on Binsur. It is for farther inquiry whether the black-fruited kind of the North-West Himalaya is a distinct species (see below *P. acaulis* var. *melanocarpa* and *P. farinifera*, Roxb.)

3. **P. acaulis**, Roxb. ; F. Hamilton in Linn. Soc. Trans. xv. 88 ; Roxb. Fl. Ind. 783 ; Griff. Calc. Journ. v. 345 ; Palms, t. 228. *Dwarf Date Palm.* Vern. *Khajuri*, *pind khajūr*, *jangli khajūr*.

A low Palm with a thick, short, ovoid stem like a bulb, densely covered with the persistent and hardened bases of petioles. Leaves 2-6 ft. long, petiole flat below, laterally compressed or 4-sided above ; pinnæ narrow-linear in remote, nearly opposite fascicles, the upper 12-18 in. long, the lower short, straight, rigid, and ending in sharp spines. Flower-panicles of varying length, half buried in the ground, or peduncle 1-2 ft. long. Fruit ovoid, ½ in. long, fleshy, bright red, sweetish. A variety with black fruit is described by Griffith (Calc. Journ. v. 346) as *P. acaulis* var. *melanocarpa*.

Common on dry stony ground in the sub-Himalayan and Siwalik tract, extending west to the Jumna, and ascending to 2500 ft. Often associated with *Sal* and *Pinus longifolia*. Abundant in the Sal forests of Oudh and the Satpura range. Chota Nagpur, Behar, Sikkim Terai, and Sal forests of the Runjit valley (*Shaap* of the Lepchas, Hooker). *Ein* or *Dipterocarpus* forest of Burma. Fl. cold season ; fr. ripens April, May.

To *P. acaulis* I am inclined to refer two species described by Griffith in Palms of East India, p. 138, 139, *P. Ouseleyana* from Chota Nagpur and Assam, and *P. pedunculata*, common and very gregarious on open ground of the hilly country about Courtallum and Kunur on the Nilgiris, at 6000 ft. elevation, both stemless with fasciculate leaflets and long fruit peduncles (fruit red and sweet in *pedunculata*). Gærtner's *P. pusilla* (Fruct. p. 24, t. 9), seems to be near this, but his specimens are said to have come from Ceylon, where only *P. sylvestris* is reported to grow (Thwaites, Enum. Pl. 329). Whether the Palm described doubtfully as *P. acaulis*, in Bentham's Fl. Hongkong. 340, belongs to this species, remains for farther inquiry.

On the Bababuden hills in Mysore, on the Satpura range, and in other parts of South and Central India, is found a small *Phœnix*, stemless, or with a slender stem, attaining 6-10 ft., leaflets slender, fasciculate, in twos and threes, less rigid than those of *P. sylvestris* and *acaulis*, fruit on long erect peduncles, 12-24 in. long, and ¼-½ in. broad, with numerous spikes 4-6 in. long, apparently the same plant, from the Ghat forests, which Dalzell (Bombay Fl. 279), doubtfully refers to *P. paludosa*. I have often found it, but do not know whether the fruit turns black when ripe, or whether it is red. This, however, may not be a character of great moment. Roxburgh, Fl. Ind. 785, describes *P. farinifera* with shining black fruit, stem 1-2 ft. high, 6 in. diameter, leaflets rigid, opposite. If it were not for the description of stem and leaves, I should be disposed to identify the slender-stemmed *Phœnix* of South and Central India with *P. farinifera*, Roxb. Hamilton (Trans. Linn. Soc. xv. 87) states that what Roxburgh calls *P. farinifera*, is common in all the hills of India south of the Ganges, and is called *Palawat* in North India; he adds, that its leaves, which are not so rigid as those of the other species, are bruised and twisted into ropes. Roxburgh states that it is a native of dry barren ground, chiefly of the sandy lands at a small distance from the sea near Coringa. Fl. Jan., Feb.; the fruit ripens in May. He mentions that mats are made of the leaves and baskets of the split petioles, that the exterior or woody part of the trunk encloses a large quantity of farinaceous substance, used as food in times of scarcity, and adds, that in 1791 and 1792 it saved many lives. The identification of Roxburgh's tree, *P. farinifera*, is a matter of importance on account of the food produced by it. The Telugu name given by him, *Chilta-eita*, is *Chittita-chettu* in Elliot's Flora Andhrica.

A marked species, which cannot be confused with any of the others, is *P. paludosa*, Roxb. Fl. Ind. iii. 789; Griff. Palms, t. 229, A. B. It forms impenetrable thorny thickets throughout the Sandarbans, in the Delta of the rivers Irawaddee and Salween (*Thimbaung*, Burm.), in Penang and on the Andamans. The stems are slender, 6-20 ft. high, annulate below, the upper part densely covered with the thorny base of petioles. Leaflets narrow flaccid, white beneath, fruit ovoid, first yellow, then red, at last black-purple, ½ in. long, not eatable.

5. COCOS, Linn.

Tall Palms, mostly with smooth annulate stems. Leaves pinnate, terminal, petioles amplexicaul with fibrous base. Flowers monoicous, inflorescence of numerous simple spikes on a short and generally thick, sometimes branching peduncle (spadix), enclosed in bud in 1 or 2 boat-shaped hard coriaceous, often woody sheaths, opening longitudinally at the time of flowering. Male flowers more numerous than female flowers, generally in the upper part of the inflorescence; calyx 3-sepalous; corolla of 3 oblong or lanceolate petals, valvate in bud. Stamens 6, filaments subulate, with or without a (minute) rudimentary ovary. Female flowers: calyx of 3 imbricate broadly ovate or rounded sepals, supported by 2 bracts similar to sepals; petals smaller than sepals. Ovary 3-celled, surrounded by 6 sterile stamens. Fruit 1-seeded; pericarp consisting of an outer fibrous layer and an inner hard osseous kernel, which has 3 pores at the base. Albumen fleshy, oily, with a central cavity; embryo cylindric at the base of the albumen, when germinating protruding through one of the pores of the kernel.

1. **C. nucifera**, Linn.; Roxb. Cor. Pl. t. 73, Fl. Ind. iii. 614; Mart.

Hist. Nat. Palm, ii. t. 88. *The Cocoa-nut Tree.* Sans. *Nārikera, nārikela, lāngalin.* Vern. *Narikel,* Beng.; *Narel, nariyal,* Hind.; *Kobbari chettu,* Tel.; *Ung ben,* Burm.

Trunk annulate, often curved or flexuose. Leaves 6-12 ft. long, pinnæ distichous, equidistant, linear-lanceolate. Sheath of inflorescence of a woody texture, cylindric, 2-3 ft. long, outside with numerous longitudinal elevated lines, inside smooth shining. Peduncle (spadix) erect, stout, divided into short thick branches, female flowers on these and at the base of the numerous slender drooping spikes which are thickly covered with the male flowers. Fruit ovoid, indistinctly 3-cornered, 10-15 in. long, the fibrous pericarp covered by a thin membranous epidermis. Cavity of the albumen large before maturity, filled with sweetish acidulous juice (Cocoa-nut milk), from which, as the seed ripens, the cellular tissue of the albumen is gradually formed. When the seed germinates, the growing embryo is maintained at first by the oil which fills the cells of the albumen, and which is gradually transformed into sugar and other substances soluble in water.

Cultivated nearly throughout the tropics, particularly in the vicinity of the sea, in Asia, in parts of Africa, in America, and on the islands of the Pacific; somewhat beyond the tropics, on the Canary Islands, in Lower Sindh and Bengal. On the Mysore plateau, cultivated like the Betel Palm in irrigated groves below the large tanks. Its original home and the history of its spread are not yet sufficiently known. The Sanscrit name indicates its ancient cultivation in India; it was, however, not known to classic writers, and it seems certain that it was introduced by the Portuguese into Western Africa and the Cape Verde Islands, and that it did not exist in the West Indies, Guiana, nor Brazil at the time of the discovery of America. It has been supposed to be indigenous in the Indian Archipelago and on the Nicobar and Coco islands of the Bay of Bengal—and this would explain its early cultivation on the coasts of India and Ceylon. But the nineteen species of this genus enumerated by Martius are all indigenous in Mexico or South America, excepting *C. nucifera* and *C. mamillaris,* Blanco, which Blume (Rumphia, iii. 84) considers as a dwarf variety with small fruit of the Cocoa-nut. Considerations of botanical geography would therefore point to the west coast of Central America as its home. Martius, indeed (Palms, i. 188), considers it not improbable that the original home of this Palm was on the islands near the Isthmus of Panama, and that the nuts were transported thence by westerly currents to Cocos Island, 200 miles west of the coast, which was found densely covered with Cocoa-nut trees, by its first discoverer, without any sign of human habitations. From there it is not difficult to explain the farther spread of the nuts by the regular currents and by storms to the Sandwich, Marquesas, and other islands of the Pacific, and to the islands of the Indian Archipelago, whence it may have been introduced into India. The Cocoa-nut is said to preserve its vitality for a long time floating in sea-water of a certain temperature. A. De Candolle, Géographie Bot. ii. 976, seems inclined to accept the American origin of the Cocoa-nut, and Grisebach (Vegetation der Erde, ii. 11) entertains no doubt on the subject. In India the Cocoa-nut flowers in the hot season, and the nuts require 9-10 months to come to maturity.

The manifold uses of the Cocoa-nut tree are well known: the outer wood of the stem is close-grained with dark-brown vascular bundles; it works smooth and takes a good polish. It weighs 70 lb., value of P. 608, Skinner; 46 lb.

value of P. between 436 and 838, Puckle. Commonly known as *Porcupine* wood, made into ornaments and fancy articles; the wood of trees past bearing is used for building. The leaves are employed for thatching, and the web-like net of fibres which surrounds the stems at the base of the petioles is made into bags and paper. The cut flower-stalks, like those of *Borassus* and *Caryota*, yield sugar and toddy, from which arrack is distilled and vinegar made; but the nuts are the most valuable part of this useful tree. The thick fibrous rind (coir) is made into ropes, mats, carpets, brushes, and a variety of other articles. The hard inner shell of the nut is made into spoons and cups, and is carved into all kinds of ornaments. The oil forms an important article of trade, it is used for cooking and burning, and in Europe for the manufacture of soap and candles. For a detailed account of the cultivation and uses of the Cocoa-nut tree, see Drury, Useful Plants of India, 147.

Elæis guineensis, Linn.; Mart. Hist. Nat. Palm, ii. t. 54, 56, of the tribe of *Cocoineæ*, is indigenous in tropical Western Africa, and cultivated in Brazil. Both the albumen and the flesh of the orange-coloured or red drupe are, like seed and pulp of the Olive, full of fat oil, the *Palm Oil* of commerce, which during the last fifty years has become a most important article of trade. The flowers are monoicous, but on distinct erect, compact, many-flowered panicles. The male flowers are crowded in numerous thick cylindric spikes, anthers 6 on the teeth of a cylindric tube. The drupes, 1-2 in. long, are ovoid, closely packed, 600-800, with lanceolate bracts between, in a huge ovoid compact panicle, often weighing 40 lb. A second species, *E. melanococca*, Gærtn., with a partly decumbent and creeping stem, is indigenous in South America.

6. CALAMUS, Linn.

Stems long flexible, scandent or supported by trees and Bamboos, rarely short, stiff, and erect; the upper part covered with leaves and the sheaths of fallen leaves, the lower part annulate. Leaves pinnate, alternate, remote; pinnæ flat, linear, rarely oblong or cuneate, often armed along nerves and edges with spinous bristles; petiole and the long persistent amplexicaul sheaths armed with rigid dark-coloured prickles, often flat and placed in continuous, horizontal or oblique lines, sometimes forming complete rings; petioles or sheaths terminating in long whip-like thongs armed with prickles, scattered, or in oblique lines or rings. Flowers monoicous or dioicous, in long axillary or extra-axillary panicles; peduncles often connate at base with the sheath of the next following leaf, armed with prickles, the main branches in the axils of cylindric sheaths, truncate or terminating in a flat or concave blade; branches and branchlets generally enclosed in a succession of cylindric or funnel-shaped sheaths. Male flowers in distichous, often scorpioid spikes, in the axils of an outer, generally broad-ovate and acute bract, with an inner, bicuspidate and cup-shaped bract, which may be regarded as analogous respectively to the flowering glume and palea of grasses. Calyx campanulate, 3-dentate. Petals 3, valvate in bud. Stamens 6, surrounding a rudimentary 3-fid ovary; anthers sagittate, adnate at the back. Female flowers often pedicellate, supported by 3 or more imbricate bracts, spirally arranged on the branchlets; calyx and petals like those of male flowers. Ovary 3-celled, surrounded by 6 sterile stamens, closely covered with imbricate reflexed scales, styles 3, recurved, 1 erect ovule in each cell. Fruit 1- rarely 2-seeded, nearly dry, with a hard shining rind, composed of numerous retrorse imbricate scales, spirally arranged on the surface of the fruit. Albumen more or less ruminate near the outside, embryo basal.

1. **C. Rotang,*** L.; Mart. Hist. Nat. Palm, iii. 334; Roxb. Fl. Ind. iii. 777; Kunth Enum. Plant, iii. 207.—Syn. *C. Roxburghii,* Griff. in Calc. Journ. of Nat. Hist. v. 43, and Palms, t. 192. *Common Rattan.* Sans. *Vetra, vetasa.* Vern. *Bet.*

Stems long, slender, climbing, enveloped in the prickly sheaths of the leaves, without the sheaths ¼-½ in. diam. Leaves 18-36 in. long, no whip at the end of petiole, but sheaths generally furnished with long prickly whip-like thongs; leaflets equidistant, opposite or alternate, linear-lanceolate, with numerous longitudinal nerves, 4-9 in. long, fine spinescent hairs along the edges and nerves. Prickles on sheath scattered, rigid, straight, with a thick concave or flat base, those on petiole chiefly at the insertion of leaflets, similar, but stouter and often recurved. Common peduncle of inflorescence with stout recurved prickles, main branches paniculate, in the axils of cylindric prickly sheaths wider and obliquely truncate at the mouth, 2-6 in. long. Fruit straw-coloured, with scanty sharply acid pulp, 1-seeded, ovoid or subglobose, ½ in. long.

Abundant in damp places, near Jheels, in the eastern Dehra Doon, locally in the Siwalik tract, the outer hills of Garhwal and Kamaon, in Nepal. Eastern part of the Khairigarh forests, and a few places in Gonda, in Oudh. Bengal, the Terai of Sikkim, valleys of the Satpura range (vern. *Pepa, prabba, chettu;* I have not seen specimens). Western Ghats, South India, and Ceylon. Fl. July; fr. in the cold season. Yields the common Rattan of North-West India, which is largely exported to the plains; chairs, door-blinds, and many kinds of basket-work are made of it.

Griffith, Palms t. 191, described a second species from the Doon as *C. Royleanus,* and Martius (Palm. iii. 335) adopted it. According to Griffith, it differs in solitary long spines of petioles and sheaths, linear leaves, the corolla as long as the calyx, and the fruit globose, not ovate. Martius adds that the fruit of this has 15, and that of *Rotang* 19-20 rows of scales; but as far as known at present, the arrangement of these scales is subject to great variations in the same species. I do not consider *C. Royleanus* distinct; but the cane-brakes of the N.W. Himalaya require farther study.

Nearly allied are the following species, which may be found within the range of this Flora. They have whip-like thongs on the sheaths, not at the end of the petiole.

C. tenuis, Roxb. Fl. Ind. iii. 780; Griff. in Calc. Journ. v. 45, and Palms, t. 193, A.B.C. Scandent, monoicous, flowers in pairs, female and male flowers on the same spike, leaflets equidistant, alternate, 3-nerved. Stems when cleaned not thicker than a common quill. Vern. *Bet.* Common in Assam, Silhet, and Chittagong.

C. fasciculatus, Roxb. Fl. Ind. iii. 779; Griff. in Calc. Journ. v. 52; Palms, t. 195, A.B. Erect when young, afterwards leaning in search of support, and climbing over trees and bushes. Leaflets collected in fascicles of 2, 3, or 4, on opposite sides of the petiole, prickles on petioles 1-2 in. long, in twos or threes at the base of the pinnæ, on sheaths broad-based, and often in oblique lines, sheaths and petioles with brownish-white mealy tomentum. Bracts of male flower-spikes large, funnel-shaped. Bengal, in the plains as well as in the hills: walking-sticks are made of the stems.

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* Linnæus's name *C. Rotang* included several species; Griffith abandoned it on that account, but Martius, after considering Griffith's objections, restored it.

The Rattan, which yields the long rope-like canes in Burma (*Yaimatta*, *Kyein*), used in the place of ropes on timber rafts, and of which the cables stretched across the Salween river at the rope-station are made, grows in moist valleys in Martaban and Tenasserim, often 200 ft. long, the elegant crown of leaves surmounting gigantic trees, over which it climbs. It is referred to *C. latifolius*, Roxb. Fl. Ind. iii. 775; Griff. Palms, t. 198, leaflets fasciculate, broadly lanceolate, petioles of older leaves ending in prickly whip-like thongs; prickles on sheaths and petioles, large in oblique rings. Also found in Eastern Bengal. The various kinds of canes and Rattans imported into Europe from India, Siam, Cochin-China, and the Indian Archipelago, are chiefly the produce of species of *Calamus* and allied genera. The Malacca cane of Sumatra is generally ascribed to *C. Scipionum*, which Loureiro described from Cochin-China.

Sago is chiefly the produce of several species of *Metroxylon* (*Sagus*) which belong to the same tribe as *Calamus*, but have tall erect stems and the heart filled with farinaceous substance. *Metroxylon Rumphii*, Mart. Hist. Nat. Palm. t. 159, and *M. laeve*, Mart., grow in the Indian Archipelago, Malacca, and Siam.

Two remarkable genera, *Nipa* and *Phytelephas*, resemble Palms in general habit, and their large pinnate leaves, but they differ essentially in the structure of the flowers. *Nipa fruticans*, Thunb.; Mart. Hist. Nat. Palm. t. 171, 172, is abundant in the mud of the Sundarbans, in the delta of the Irawaddee and Salween rivers, and elsewhere on the coasts of the Bay of Bengal, and on the islands of the Indian Archipelago. A creeping stem bears tufts of gigantic feathery pinnate leaves often more than 20 ft. long. The flowers are monoicous on one inflorescence, a thick spadix with numerous bracts, bearing numerous lateral deciduous male catkins, and at the ends of each branch a few heads of female flowers. The male flowers are triandrous, the 3 stamens connate into one column; the female flowers are without any perianth. The fruit forms large compact rounded heads, consisting of numerous 1-seeded fibrous angular drupes with a hard horny albumen.

Phytelephas macrocarpa, Ruiz et Pavon; Bot. Mag. t. 4913, 4914, has hard seeds which are largely imported into England, under the name of Vegetable Ivory, and used extensively for turning. Like *Nipa fruticans* it is gregarious, and has a creeping stem often 20 ft. long, with large pinnatifid leaves, 18-20 ft. long. The flowers are generally dioicous; the male flowers with numerous stamens; the female flowers with a 6-9-celled ovary, and a long erect 6-9-fid style. Western South America, between the 9th degree of north and the 8th of south latitude.

ORDER LXXVIII. GRAMINEÆ.

Annual herbs with a fibrous root, or a perennial underground stem (rhizome) producing annual or perennial stems (culms), generally in tufts or clusters. Rhizome mostly branching, composed of vascular bundles scattered in cellular tissue. Stems jointed, usually hollow between joints; the joints near the ground often with rings of adventitious rootlets (specially in Bamboos). Leaves alternate, consisting of a tubular sheath, split to the base, and a narrow, linear or lanceolate blade (in *Bamboos* joined to the sheath by a petiole); inner face of sheath often prolonged into a membranous or coriaceous ligule. Flowers mostly bisexual, arranged in distichous 1- or many-flowered spikelets. Spikelets supported at the base and often enclosed by two or more bracts (empty glumes), the axis or rachis bearing one or numerous distichous bracts (flowering glumes). Each flowering glume bears in its axil, on the short axis of the flower, the palea, a membranous, generally transparent bract, mostly 2-keeled. Between palea and the flowering glume are a 1-celled ovary, with 2 distinct, often lateral, styles, or 1 terminal style, generally 2- or 3-fid, surrounded by 3, 6, rarely more or fewer stamens, and 2 or 3 membranous, often ciliate scales (lodicules). Anthers 2-celled, cells contiguous, opening longitudinally. Fruit a 1-seeded caryopsis, pericarp generally closely adhering to the testa, and sometimes (*Oats*, *Barley*) adhering to the palea and flowering glume. Embryo at the base of the albumen on the outside, small, its position conspicuous on the surface when the pericarp is thin and closely adhering to the testa; not conspicuous when the pericarp is thick, coriaceous, woody or fleshy. Albumen farinaceous, composed of thin-walled cells, filled those near the outside with albuminous (nitrogenous) substances, the mass of the cells chiefly with grains of starch. Embryo consisting of a broad cotyledonary body (scutellum) contiguous to the albumen, a basal radicle and the plumule. When germinating, the scutellum remains enclosed in the seed, the radicle protrudes and lateral root-fibres emerge from it, while the plumule, in the opposite direction, unfolds its leaves. During the process of germination the starch of the albumen is gradually converted into sugar and other soluble substances, which pass into the embryo through the scutellum, and serve as the food of the plant in the first stage of its growth.

Grasses comprise upwards of 4500 species, grouped under numerous tribes. Those here described all belong to the tribe *Bambuseæ*, which are characterised by woody, mostly perennial stems (culms) with numerous branches at the nodes, leaves petiolate, articulate at the base of the petiole, deciduous, leaving the branchlets surrounded by persistent, generally coriaceous sheaths, stamens 3 or 6, rarely more, style 1, 2-3-fid, rarely undivided. As in Palms, the vascular bundles in the inner part of the Bamboo stem are composed of vessels, cells, and fibres, while those near the surface consist of fibres only. These are close together, almost confluent, forming the hard outer rind of the Bamboo. At the nodes the vascular bundles cross from one side of the stem to the other, forming the principal mass of the hard horizontal partition walls which separate the joints. The stem of Bamboos with hollow joints has much less cellular tissue than the stem of Palms, and the vascular bundles differ in shape also. Morphologically and with regard to its anatomical structure, the underground stem (rhizome) of Bamboos has more analogy with the perennial stem of Palms like *Phœnix*, *Borassus*, *Cocos*; but these points demand farther study. An excellent monograph of Bamboos by General Munro is published in the 26th volume of the Transactions of the Linnean Society, where the number of species described is 170.

Cæspitose shrubs with slender, mostly annual stems; spikelets pedunculate, racemose or paniculate; stamens 3.
  Branches of panicle in the axils of small linear bracts . 1. ARUNDINARIA.
  Branches of panicle in the axils of large amplexicaul bracts 2. THAMNOCALAMUS.
Compact clumps of tall perennial stems; spikelets generally sessile, in interrupted spikes; stamens 6.
  Lodicules 2 or 3; style deciduous, deeply 2- or 3-fid; embryo conspicuous on the surface of the caryopsis . 3. BAMBUSA.
  Lodicules none; style filiform, undivided or 2-3-fid at the apex, base persistent; embryo not conspicuous on the surface of the caryopsis . . . . 4. DENDROCALAMUS.

1. ARUNDINARIA, Michaux.

Stems slender, generally annual, erect, cæspitose, with small leaves. Inflorescence generally terminal, paniculate or racemose; in some species the flowers are on distinct leafless culms. Spikelets 2-12-flowered, flowers distant, distichous, imbricate, mostly bisexual, the terminal generally sterile. Empty glumes 2, narrow, with few nerves, the lower smaller than the upper. Flowering glume concave, with numerous nerves. Palea 2-keeled, narrow, generally shorter than the flowering glume. Scales 3, ciliate. Stamens 3. Style divided at the top into 2 or 3 plumose stigmas. Caryopsis terete, with a deep furrow.

1. **A. falcata**, Nees; Munro in Trans. Linn. Soc. xxvi. 26.—Syn. *A. utilis*, Cleghorn. Vern. *Nirgāl*, *nigāl*, *ringal*, *nagre*, *narri*, *garri*, *gero*. Local n. *Spiūg*, *gorwa*, *spīksu*, *pitso*, Kunawar; *Kwei*, Tibet; *Prong*, N.W.P.

Stems annual, 6-10 ft. high, densely cæspitose, ¼-⅓ in. diam., hollow, internodes 6-12 in. long, the sheaths on young shoots thinly membranous, glabrous 6-7 in. long, tapering into a subulate apex 1½ in. long. Branches slender, numerous, in compact half-whorls. Leaves linear, 4-5 in. long, ¼-⅓ in. broad, glabrous above, with scattered soft long hairs underneath; midrib prominent, whitish, longitudinal nerves numerous, 3-5 pair, prominent; no transverse veins. Flower-bearing stem leafless; branches slender, numerous, in compact half-whorls. Spikelets in paniculate racemes, the principal ramifications in the axils of short linear or ovate membranous bracts. Spikelets lax, ½-¾ in. long, 2-3-flowered, the terminal flowers generally sterile. Empty glumes 2, about half the length of the lowest flower, membranous, with prominent longitudinal nerves, apex obtuse, ciliate. Flowering glume scabrous, acute, 7-9-nerved, membranous, hairy at the apex. Palea as long as the flowering glume, 2-keeled, with longitudinal nerves outside the keels. Scales 3-nerved and fimbriate. Style deeply bifid.

North-West Himalaya between 4500 and 10,000 ft., ascending to 12,000 ft. from the Ravi to Nepal, abundant in places, gregarious, often forming underwood in moist forests of *Abies Smithiana*, *A. Webbiana*, *Quercus semecarpifolia*. Fl. May, the seeds ripen in August. Clusters compact, of 100 or more stems, attains 20-40 ft. according to Madden. Hardy in England. Two kinds are generally distinguished, one growing at lower elevations (up to 7000 ft.), thinner, with solid or nearly solid culms and narrow leaves, the other, growing between 8000 and 12,000 ft., with shorter, thicker, and hollow culms and broader leaves, the foliage more feathery. Vern. *Garu girch* (Powell, Panjab Products, 518, 567). It is a matter for inquiry whether one of these is not *Thamnocalamus spathiflorus*, or another species of *Arundinaria*. The solid kind is said to be the tougher of the two, and is used, when dry, a year after cutting, to support the earth-roofs of the hill-cottages. It is also made into mats and basket-work. The hollow kind is made into shepherds' pipes, fishing-rods, and is exported to the plains for Hooka-tubes ; it is also employed for basket-work.

The small Bamboo of the Nilgiris is *A. Wightiana*, Nees ; Bedd. Fl. Sylv. Anal. Gen. t. 28; annual stem 6-12 ft. high ; flowers in terminal slender-branched panicles at the end of leaf-bearing culms, spikelets 2-5-flowered, ¼-½ in. long, single, on long filiform peduncles, leaves with indistinct transverse veins, sheaths persistent, coriaceous, adpressed to branchlets.

2. THAMNOCALAMUS, Falconer.

Characters of *Arundinaria*, excepting the bracts subtending the main branches of the inflorescence, which are lanceolate or ovate-lanceolate, enclosing the racemes of spikelets in bud, and exceeding half their length when fully developed.

Leaves with prominent transverse nerves; sheathing bracts 3 in. long	1. *T. spathiflorus.*
Leaves without transverse nerves; sheathing bracts less than 1 in. long	2. *T. Falconeri.*

1. **T. spathiflorus**, Munro l. c. 34.—Vern. *Ringall*, Deoban range.

Stems cæspitose, ¼ in. diam., internodes 4-8 in. long, brown, shining, branches 12-18 in. long, in fascicles or in half-whorls ; the sheaths on young shoots glabrous, with numerous prominent nerves, fimbriate at the mouth and edges, narrowed somewhat abruptly into a distinct, subulate apex 2 in. long. Leaves 3-5 in. long, ⅓-½ in. broad, distinctly petiolate, 3 prominent secondary nerves on either side of midrib, transverse nerves conspicuous ; sheath 2 in. long, striated with raised longitudinal lines, fimbriate at the mouth, with a long ligula, persistent after the leaves fall, forming an acute angle with branches. Flowers in large panicles, with slender drooping branches. Racemes of 2 or 3 spikelets in the axils of large amplexicaul oblong multinerved bracts 3 in. long. Spikelets linear-lanceolate, 1-1¼ in. long, of 6-8 hairy distinct flowers. Empty glumes 2, white, membranous, glabrous, linear-lanceolate. Articulation of rachis between two flowers ¼-⅓ the length of flowering glume. Flowering glume ½-¾ in. long, long-acuminate, 7-9-nerved, roughly hirsute, with long hairs at the base. Palea much shorter than flowering glume, 2-ribbed, with 2 nerves between the ribs, and 2 on each side. Scales 3, lanceolate. Stamens 3. Style 3-fid.

Upper part of Hattu (8400 ft.), T. Thomson, Aug. 1847. Deoban (8000 ft.) D.B., May 1863. Dūdatoli in Garhwal (8500 ft.), Strachey and Winterbottom. In Kamaon, Nepal, and in Sikkim on Mount Singalelah at 11,000 ft. Hooker.

2. **T. Falconeri**, Hook. fil ; Munro l. c. 34.

Leaves thin, 3-4 in. long, ⅓-½ in. broad, narrowed into a slender petiole; sheaths membranous, truncate below the petiole. Flowering branches (on leafless culms?) numerous, slender, 12-18 in. long, bearing numerous distant short racemes. Racemes sessile, 1 in. long, supported at the base by 6-8 imbricate membranous bracts, the outer shorter, ovate, the inner ovate-lanceolate, nearly as long as spikelet. Spikelets glabrous, of one fertile and a terminal sterile flower; empty glumes 2, more than half the length of spikelet.

Madhari Pass, Kamaon (8000 ft.), Strachey and Winterbottom. Nepal.

3. **BAMBUSA**, Schreber.

Large, mostly erect, often gigantic Bamboos, the stems generally massed together in compact clumps or clusters. Flowers in a few species on leaf-bearing stems, generally on stems without leaves, which die after the seed is ripe. In some species one or a few stems only of the entire cluster bear flowers at one time—these are the ~~Bamboos~~ which flower annually; in others all or nearly all stems of one cluster come into flower at the same time, followed by the death of the entire cluster—these are the Bamboos which flower after long periods, for it generally happens that all or most clusters of the same species come into flower simultaneously in one district, so that in one year all Bamboos of one species die over extensive areas, followed by a dense mass of seedlings, which come to maturity and bear flowers after a period varying according to circumstances. Spikelets generally many-flowered; empty glumes 2 or more, the lower shorter, the upper similar to the flowering glumes. Palea 2-keeled, keels generally fimbriate. Scales 3, ciliate, membranous or hyaline. Stamens 6. Caryopsis with a deep longitudinal furrow, often adhering to the palea and flowering glume.

Branches spinescent; leaves small . . . . 1. *B. arundinacea.*
Branches unarmed.
  Spikelets terete.
    Leaves middle-sized, pale and soft-pubescent beneath, transverse veins none, spikelets 1-2 in. long, joints of rachis elongated, thickened into a hairy disc under the flowering glume; scales cuneate, thickened at base, but without prominent nerves . . . . 2. *B. Tulda.*
    Leaves large, concolorous, glabrous but scabrous along edges, transverse veins distinct; spikelets ⅓-½ in. long, joints of rachis short, glabrous; scales ovate or obovate, with distinct longitudinal nerves . . . 3. *B. Balcooa.*
  Spikelets laterally compressed, flowers distichous; leaves with distinct transverse veins . . . . . . 4. *B. vulgaris.*

1. **B. arundinacea**, Retz; Munro l. c. 103; Roxb. Cor. Pl. t. 79; Fl. Ind. ii. 191; Bedd. Fl. Sylv. t. 321.—Sans. *Vansa.* Vern. *Magar bāns, nāl bāns,* Pb.; *Bāns, kattang, kuttung bāns,* N.W. and Central India; *Mandgay,* Bombay (Dalzell); *Veduru,* Telugu.

Stems tall, green, shining, with spinescent branches, packed close in large compact clumps of 30-100, generally 30-50 ft. high, but attaining much larger dimensions on the west coast and in the Satpura. Joints 4-9 in. diam., walls thick, cavity small; lower branches stiff, green, spreading, spinescent, with a few leaves; upper branches alternate, regularly distichous. Spines strong, sharp, curved, either in pairs at the base of a branch, or in threes, the middle one the largest. Leaves small, thin, lanceolate, 4-8 in. long, and $\frac{1}{3}$-$\frac{2}{3}$ in. broad, generally glabrous, sometimes with scattered hairs underneath, 5-6 pair of prominent longitudinal nerves on either side of midrib; sheaths persistent, coriaceous, 1-2 in. long, glabrous or pilose with scattered hairs, more or less fimbriate at mouth or edges. Flowers at long intervals, probably at the age of thirty years, all stems of one clump being covered with flowers at the same time, a few leaves often appear with the flowers. Spikelets mostly sessile, in dense half-whorled clusters at the nodes, glabrous, shining, the fimbriate edges of the palea prominently apparent. Empty glumes 2-4; flowering glumes 4-10, the upper generally staminiferous only and sterile. Flowering glume thickened and mucronate at the apex, wholly glabrous, not ciliate at the edges, often shorter than the palea. Scales 2, hyaline, fimbriate. Anthers with an obtuse glabrous point between the cells. Ovary glabrous; style deeply 2- or 3-fid, stigmatic branches long-plumose. Caryopsis $\frac{1}{2}$ in. long, enclosed in glume and palea.

Throughout South India, particularly abundant in the Anamallays, Wynad, the adjoining forests of Mysore, Coorg, Malabar, and Canara. In Belgaum, the Khandeish Dangs, at Sironcha on the Godavery. On two feeders of the Bagh river, a tributary of the Wainganga at the base of the Satpura range. Jubbulpur, Bengal, and (cultivated) in the sub-Himalayan tract of the Panjab.

The stems attain 70-90 ft. in the forests of Bejagarh near the Bagh river, and on the western coast. The manifold uses of this Bamboo for building, scaffolding, ladders, carrying and tent poles, the masts of boats, water-pipes, and various other purposes, are well known. Continued immersion of Bamboos in water, or better still in a solution of sulphate of iron or lime-water, renders them more durable. It forms thick and impenetrable hedges. In Hyder Ali's time, the town of Bednor in north-west Mysore, was defended by a deep trench filled with clumps of this Bamboo.

Isolated flowering clumps of this Bamboo are found occasionally, but as a rule all clumps in one district come into flower simultaneously, a few clumps flowering in the previous, and some in the succeeding year. After the seed ripens, the stems die down to the ground, and in the following year a dense mass of seedlings springs up, forming during a series of years a close thicket of slender stems, until the young rhizome gets sufficient strength to produce larger shoots. Shoots of a full-grown rhizome attain their full length in one or two months, being covered in that stage with large leafless hairy sheaths. Subsequently the leaf-bearing branches develop in the axils of their sheaths, and the stem gradually matures and gets hard and firm. It is a matter for farther inquiry whether this and other Bamboos come into flower after they have attained a certain age. Beddome (Fl. Sylv. Manual, p. 229) is of opinion that this species generally flowers at an age of about 32 years, there being a flowering on record (on the western coast) in 1804, 1836, and 1868. In Canara, however, this species (probably), *Bidungulu*, Can., flowered in the Sūpa forests in 1864. This difference is in accordance with what I have observed in the case of other species (*B. polymorpha*, *Kyathounwa*, *B. Tulda*, *Teiwa*), that though the Bamboos of the same kind in one district flower simultaneously, those in another district follow a few years later. The large Bamboo (this species probably) on the Nerbudda between Jubbulpur and Mandla flowered and died in 1839, and the same happened a few years ago. Dr Hooker (Him. Journals, i. 155) is of opinion that Bamboos do not flower at any prescribed age, but at any period when full-grown and the circumstances of the season are favourable to their flowering. The question is by no means cleared up, and more accurate records of the flowering, not of Bamboos generally, but of certain species, are wanted. It also is a matter for farther inquiry, whether the rhizomes of those Bamboos, all stems of which flower and seed, die or produce fresh shoots. What I have seen in Burma and India, leads me to think that they die, and that in such cases reproduction takes place entirely from seed. It is different with those kinds of which a few stems only of one clump come into flower. The seed of this and other species of Bamboo has often saved the lives of thousands in times of scarcity, 1812 in Orissa, 1864 in Canara, and 1866 (probably *B. Tulda*) in Malda. When young, the hollow joints of Bamboos are partly full of a watery liquid, which gradually dries up as the stems get older. It is not impossible that the well-known silicious deposit (*Tabasheer*), which is found in the joints of this and other species, may be the residuum of the fluid which often fills the joints. The ashes of all Bamboos are rich in silica.

B. spinosa, Roxb. Fl. Ind. ii. 198; Munro l. c. 104; Bedd. Fl. Sylv. 231, is believed to differ in more solid stems, a paler-coloured and more striated flower-panicle, smaller and more coriaceous spikelets, with fewer flowers and generally smaller leaves often hairy on the under side. Bengal and Burma, and, according to Beddome, on the north-east (not on the west side) of the Madras Presidency. S. Kurz, however, calls the Burmese *Kyakatwa*, *B. arundinacea*, and I have never been able to find any difference either in growing or in herbarium specimens between the thorny Bamboo of Western India and Burma. Pending farther research, I am inclined to unite the two species.

2. **B. Tulda**, Roxb. Fl. Ind. ii. 193; Munro l. c. 91.—Vern. *Peka Bans*, Hindi; *Tulda Bans*, Beng.; *Theiwa*, Burm.

Stems tall, unarmed, the joints with a large cavity and thin walls. Leaves lanceolate, 6-9 in. long, about 1 in. broad, glabrous above, underneath pale and with short soft pubescence, edges scabrous; 6 pairs of slightly prominent secondary nerves, transverse veins none; sheaths glabrous, with 2 distinct rounded, auriculate, often fimbriate lobes at the base of the short flat petiole. Flowers at long intervals, all stems of one clump bearing flowers at the same time, each stem being converted into an "immense oblong waving panicle, composed of innumerable supra-decompound ramifications" (Roxb.) Spikelets lanceolate, 1-2 in. long, sessile, in clusters of 4-10, in long slender, interrupted, often branching spikes, 12-24 in. long, 1 or several stout and woody branches at each node, bearing numerous lateral spikes, and surrounded at the base by fascicles of slender sometimes branching spikes. Spikelets glabrous, shining, 4-10-flowered, with 4-6 empty glumes at the base, which are often gemmiparous. Joints of rachis elongated, thickened into a hairy disc under the flowering glume, and distinctly articulate at that point, joints one-third the length of the flowering glume. Flowering glume mucronate, with 13-15 broad, whitish, prominent nerves, slightly pubescent at the edges near apex. Palea sharply 2-keeled, keels long-ciliate, but not conspicuous without removing the flowering glume; 7 prominent nerves between the keels. Scales cuneate-oblong, obliquely truncate, irregularly cut and fimbriate with broad subulate teeth, base thickened, particularly on one side, edges and upper part transparent, no distinct nerves, the third lodicule generally long, linear. Anthers glabrous, connective with a short blunt apex. Ovary obovate-oblong, hirsute; style deeply 3-fid.

The common Bamboo of Bengal. Not uncommon in the deciduous forest of Pegu, generally occupying lower and moister stretches of ground in company with *Tinwa* (*Cephalostachyum pergracile*, Munro), the dry hills surrounding being covered with *Dendrocalamus strictus*. Also associated with *Bambusa polymorpha*, Munro, *Kyathounwa*. Fl. May. Generally used for roofs and scaffolding, found more durable if soaked in water previous to being used. The young shoots are pickled. Used largely to make mats for the walls and roofs of cottages. Baskets, fans, and window-blinds are made of it.

B. nutans, Wall.; Munro l. c. 92, of Nepal, Assam, Kasia hills, and Silhet, agrees with *B. Tulda* in all essential characters; the leaves are of medium size, pale beneath and with slight soft pubescence, the spicules are long, with elongated distinctly articulate clavate joints of the rachis, terminating in a hairy disc under the flowering glume, the fimbriate edges of the palea are not conspicuous on the face of the spikelet, the connective of the anthers terminates in a blunt glabrous point, and the lodicules are cuneate, with a thick base and without prominent nerves. Munro states that it is a much smaller plant, with a slender and nearly solid stem, the leaves whiter below, and few fertile spikelets. Nepal, Sikkim at 5000 to 7000 ft. (vern. *Mahlo*), Assam (*Bidhūli Bans*, *Mukial Bans*), Kasia, Silhet, and, according to Dr Stewart, in the Siwalik tract, probably extending west to the Ganges.

3. **B. Balcooa**, Roxb. Fl. Ind. ii. 196; Munro l. c. 100.—Vern. *Balku Bans*, Beng.

Stems tall unarmed, stouter and often taller than of *B. Tulda*. Leaves oblong-lanceolate, with a large rounded subcordate base, 6-12 in. long and 1-2 in. broad, glabrous, green on both sides, edges scabrous; secondary nerves 7-11 on either side of midrib, not very prominent; transverse veins distinct but distant; sheath truncate at the base of the short petiole; ligula membranous, broadly triangular. Spikelets $\frac{1}{3}$-$\frac{1}{2}$ in. long, ovoid-lanceolate, 4-6-flowered, conspicuous by the fimbriate keels of paleæ, sessile, in compact half-whorled clusters on long interrupted spikes. Empty glumes 2, unequal. Flowering glumes thin, membranous, with a broad concave base, and a wide membranous edge, ciliate near the top, with prominent longitudinal nerves. Rachis not distinctly articulate, joints short, glabrous, not much thickened below the flowering glume. Palea as long as flowering glume, fimbriate at keels and hairy at edges; nerves indistinct; lodicules ovate or obovate, with longitudinal branching nerves, each branch terminating in a long subulate cilia or tooth. Anthers glabrous, connective terminating in a short dark point.

Bengal, Assam (*Bara Balūka*), Cachar. Reckoned the best Bamboo in Bengal for building, scaffolding, and other works requiring both size and strength. Long immersion in water tends to make it firmer, and proof against the attacks of Bostrichi (Roxb.) To *B. Balcooa* I am inclined to refer the large Bamboo which is cultivated near villages in the outer hills below Simla, as high as Sairi (5500 ft.), but not higher. The stems attain 40 ft., they are branchless to a height of about 5 ft., the rings at the nodes are nearly horizontal, the joints 12-18 in. long and 3 in. diam.; the sheaths of young shoots are large, densely covered with black hairs, their breadth at base about half their length, narrowed into a triangular apex, longer than broad, and about ⅓-¼ the length of the sheath. Leaves large, 9-12 in. long, 1-2 in. broad, very scabrous at edges, otherwise glabrous; secondary nerves 7-11 on either side of midrib, not very prominent, transverse veins distinct, but distant. I have never found it in flower.

B. Falconeri, Munro l. c. 95, is a remarkable species, described from flowering specimens collected by the late Dr Falconer in the Dehra Doon in Sept. 1840. Spikelets lanceolate, wholly glabrous, nearly 1 in. long, about 10-flowered, the upper 4-5, fl. male or sterile, with short effete anthers. Flowering glumes mucronate, with numerous broad prominent nerves somewhat resembling those of *B. Tulda*. Palea much shorter than glume, 2-keeled, keels fimbriate; 7 distinct nerves between keels, and 2 lateral nerves on either side of keels. Anthers pilose at the top, lodicules 3, with prominent longitudinal nerves terminating in subulate teeth. Leaves, supposed by Munro to belong to the same species, collected by Falconer in the previous year (Oct. 1839), and by Strachey and Winterbottom at 4000 ft. elev. on Okenath in Garhwal, are 16 in. long, 3 in. broad, with 14 to 16 pair of prominent secondary nerves and distinct transverse veins, concolorous and glabrous, but scabrous beneath, they resemble the leaves of *Dendrocalamus Hamiltonianus*. The identification of the large Bamboo of the Dehra Doon and of the outer ranges between Kalka and Sairi remains for farther inquiry.

4. **B. vulgaris**, Wendl.; Munro l. c. 106; Dalzell Bombay Fl. 299; Bedd. Fl. Sylv. Manual, p. 232.—Syn. *B. Thouarsii*, Kunth; *B. arundinacea*, Aiton. *Kulluk*, *bamboo*, Bombay; *Una gass*, Ceylon.

Stems tall unarmed, 20-50 ft. high, green, yellow, or with green and yellow stripes, joints 4 in. diam. and more, with thin walls. Leaves thin, linear-lanceolate, 6-10 in. long, ¾-1½ in. broad, very scabrous on the longitudinal nerves close to the edge, secondary nerves conspicuous, 6-8 on either side of midrib, transverse veins numerous. Flowering stems often leaf-bearing. Spikelets sessile, oblong-lanceolate, laterally compressed, ½-1 in. long, glabrous, 4-12-flowered, distichous, so that the flowers of each side appear distinct, and separated by a furrow, fasciculate, or in compact half-whorls on long, interrupted, paniculate spikes. Empty glumes 2; flowering glumes ovate-lanceolate, narrowed at the base, longitudinal nerves prominent near apex, indistinct below, mucronate and ciliate at the apex, fimbriate keels of palea conspicuous near the top of flowering glume. Lodicules transparent, thinly membranous. Anthers penicillate at the apex, with short hairs. Style slender, filiform, 2-3-fid at the end.

Cultivated in many districts of India, particularly in the western Dekkan, Kolapur, Sattara, Poona, Silhet, Cachar, Chittagong. In the eastern Panjab, according to Stewart. Abundant in Ceylon, up to 2000 ft. (Thwaites Enum, 375). Indian Archipelago, tropical America, and the West Indies. Commonly grown in conservatories in Europe, where it not rarely comes into flower.

4. DENDROCALAMUS, Nees.

Characters those of *Bambusa*, several species (*D. strictus*, *D. Hookeri*) are known to flower annually. Scales none. Ovary hirsute; style long, filiform, undivided, or 2-3-fid at the apex, base persistent. Caryopsis with a thick pericarp, narrowed into the persistent base of the style; position of the embryo generally not conspicuous on the surface.

Spikelets linear-lanceolate, spinescent . . .	1. *D. strictus*.
Spikelets cuneate, soft-membranous . . .	2. *D. Hamiltonii*.

1. **D. strictus**, Nees.—**Tab. LXX.**—Munro l. c. 147; Bedd. Fl. Sylv. t. 325.—Syn. *Bambusa stricta*, Roxb. Fl. Ind. ii. 193, not Cor. Pl. t. 80, which is *Oxytenanthera Thwaitesii*, Munro, a Bamboo of Ceylon, the Nilgiris, and Shevaroy hills—Munro l. c. 129. *Male Bamboo.* Vern. *Bāns*, North India. *Myinwa*, Burma. *Bās*, *Udha*, Bombay.

A middle-sized, generally deciduous Bamboo, stems with small cavity, or entirely solid, closely packed in dense clumps, the lower part of stem often variously bent, with fasciculate, stiff, horizontal, generally leafless branches, the upper part spreading out in all directions, often curved downwards, or nearly horizontal, with fasciculate slender flexuose solid branches, the leaves on fasciculate branchlets enclosed in coriaceous shining persistent sheaths; joints 12-18 in. long, 1-3 in. diam. Sheaths of young shoots shorter than joints, glabrous, shining outside, tapering into a triangular apex. Leaves distichous, hairy beneath, rough and often hairy above, exceedingly variable in size, generally middle-sized, 3-9 in. long, ¼-1 in. broad, with 6 pairs of secondary nerves, and no transverse veins. Flowers annually, 1 or a few stems of each clump only producing flowers, often mixed with leaf-bearing branches. Spikelets spinescent, hairy, forming, with a number of sterile spikelets, dense globose spiny heads arranged in long interrupted spikes, joints between the flower-heads about 1 in. long. Empty glumes 2-6, flowering glumes 2-3, generally 2, spinescent, hairy. Palea of lower flower 2-keeled, keels pilose, of upper flower convex, not keeled, 8-nerved. Ovary stipitate, hairy, style long filiform. Caryopsis brown, shining, ovoid, ⅓ in. long, narrowed into the persistent hairy style, pericarp (perigynium, Munro) coriaceous, separable from the seed, narrowed into the hairy persistent base of style.

Widely spread, and very common throughout India and Burma, up to the borders of the arid tract. On the Aravalli hills, where I found it wild near Todgarh in Mairwara. In the Panjab only in the sub-Himalayan tract, locally in a few places, and on the east side of the Salt range; not in Sindh. Not in Ceylon, but in Java. Ascends to 3000 ft. in the Peninsula, and to 3500 ft. in the outer N.W. Himalaya. In the Panjab it is common near the Sutlej, forms two forests of importance on the left bank of the Bias, several small tracts on the Chenab, and covers a considerable area west of the Jhelam, north of Rawulpindi. Generally gregarious, forming extensive forests on dry hot stony hills. The young foliage, which appears in May, is bright green, the old leaves get yellow and fall during winter, except on moist ground, where this Bamboo remains green throughout the year. Fl. between Nov. and April, the seed ripening in June. The stems that have flowered die after the seed ripens. Attains 20-40 ft. in the Panjab, in South India it grows 30-50 ft. high; in Burma, on dry hills, 20-40, and on moist ground 100 ft. The stems attain their full height in a few weeks at the commencement of the rains; in the Panjab they do not harden fully during the first year. The stems are strong and elastic, they are much used for roofing, basket- and wattle-work, and they make excellent spear-handles. In the Bamboo forests of the Panjab and the North-West, the different sizes and descriptions of this Bamboo, as they are brought to market, are classified under a multitude of names.

2. **D. Hamiltonii**, Nees et Arnott; Munro l. c. 151.—Vern. *Pao* of Lepchas, *Wuh* of Mechis in Sikkim.

Stems tall, 40-60 ft. high, joints short, 4-7 in. diam., with thick walls. Leaves firm, subcoriaceous, 6-15 in. long, 2 in. broad, glabrous above, rough, often hairy and generally pale beneath, transverse veins and 12-15 pairs of secondary nerves prominent on the under side, indistinct on the upper side of leaf; sheath of leaf projecting considerably on both sides beyond the short petiole, continued into an obliquely truncate coriaceous ligula. Flowers annually; spikelets in long interrupted panicled spikes, common peduncle thick, hollow, with numerous elevated longitudinal lines. Spikelets soft, membranous, glabrous, not spinescent, cuneate, in rounded compact lateral heads, each head supported by several broad shining bracts. Empty glumes 2, subequal, flowers 2-4, one only fertile. Style long, filiform, 3-fid at the apex.

Sikkim and Bhutan 2000-5600 ft., Assam. The young shoots are boiled and eaten.

D. Parishii, Munro l. c. 149, is described from flower-spikes only, believed to have been collected in the Panjab Himalaya by Lt. Parish. It is closely allied to *D. Hamiltonii*, but differs by ovate-lanceolate acute spikelets. If the specimens were really found in the Panjab, then it is not impossible that they belong to the large-leaved Bamboo of the Dehra Doon, or to the one of the outer hills below Simla, which has been doubtfully referred to *Bambusa Balcooa*, for the leaves of both, particularly of the former, resemble those of *D. Hamiltonii*.

Another Himalayan Bamboo of this group is *D. Hookeri*, Munro l. c. 151. Leaves similar to *D. Hamiltonii*, but larger, 15 in. long and 3-4 in. broad, secondary nerves 15 pairs, with transverse veins very prominent on the under side, indistinct on the upper side of leaf. Spikelets ovate, apex tapering, hairy. Assam, Kasia hills, Vern. *Assey*. Nearly allied, but a smaller-sized Bamboo, 20-30 ft. high, with a longer 8-flowered spikelet, is *D. latiflorus*, Munro l. c. tab. vi., of Hong Kong and Formosa.

ADDITIONS AND CORRECTIONS.

P. 3. *Schizandra grandiflora*, H. f. and Th.; Fl. Ind. i. 44.—Syn. *Kadsura grandiflora*, Wall. Tent. Fl. Nep. t. 14 (*Magnoliaceæ*). A glabrous climbing shrub, without stipules, with white, fragrant, drooping axillary flowers; ovaries numerous, imbricated on a conical receptacle, which lengthens in fruit into a cylindrical fleshy axis, 6-9 in. long, bearing numerous scarlet, fleshy, 2-seeded carpels. Himalaya, Sutlej to Bhutan, between 6000 and 10,000 ft. Fl. April, May; fr. Oct. The fruit is eaten.

P. 3, line 17 from below, *dele* "gynophore stalked."

P. 3 „ 4 „ *read* "carpels in a loose stalked spike," *instead of* "capsules sessile on an elongated stalk."

P. 5. *Polyalthia cerasoides*, Benth. & Hook. Prome district, S. Kurz.

P. 8. *Stephania rotunda*, Lour.; Hook. Fl. Ind. i. 103.—Syn. *Cocculus Roxburghianus*, Wall. *Cissampelos glabra*, Roxb. Fl. Ind. iii. 840. *Menispermaceæ*. Vern. *Gajera*, *garjial*, Kamaon. A large glabrous climber with a subglobose tuberous root. Leaves peltate, broad-ovate or suborbicular, often repand or sinuate-lobed, pale beneath, 3-7 in. diam. Flowers yellow, in axillary cymose umbels. Male flowers: sepals 6-10, narrow-cuneate, biseriate, petals 3-5, obovate, anthers 6, connate, inserted round the top of the staminal column, bursting transversely. Female flowers: sepals 3-6, petals of the male. Drupe glabrous, endocarp compressed, horseshoe-shaped, dorsally tubercled, sides hollowed and perforated. Seed almost annular. N.W. Himalaya, ascending to 7000 ft. Kasia hills, Burma. Fl. April-June. For the structure of the wood see Hooker & Thomson, Flora Indica (1855), p. 195.

P. 8. *Tinospora cordifolia*, Miers.—Vern. *Gūrcha*, Kamaon.

P. 8. Under *Anamirta Cocculus*. For a full description of this climber, see Wallich, Descriptions of Indian Plants in Asiat. Researches, xiii. 403.

P. 10. *Cissampelos Pareira*, Linn.—Vern. *Pari*, Kamaon. The botanical origin of the various stems and roots known as *Pareira Brava* and *Radix Pareirae* has lately been investigated by D. Hanbury (Pharm. Journ. 1873, Aug. 2d and 9th). The result is, that the drug is not yielded by this plant. One of the best kinds is the root of *Chondodendron tomentosum*, Ruiz and Pavon, a large climber of the same Family in Brazil, with bunches of large oval berries.

P. 12. *Berberis asiatica*, Roxb.—Vern. *Kilmora*, *kingora*, Kamaon.

P. 12. *B. Lycium*, Royle.—Vern. *Kingora*.

P. 12. *B. nepalensis*, Spreng.—Vern. *Pande kilmora*, *chotara*, *chotra*, Kamaon. Hardy against walls in England.

P. 13. *Holbællia latifolia*, Wall.—Syn. *Stauntonia latifolia* and *S. angustifolia*, Wall. Vern. *Gophla*, Kamaon. The fruit is eaten.

P. 14. *Capparis aphylla*. A common and characteristic shrub of Soudan, N.L. 15°-20°, as far as Timbuktu on the Niger, according to Barth.—(Grisebach Veg. d. Erde, ii. 123.)

P. 15. *Capparis horrida*, Linn. fil.—Vern. *Ulta kanta, bipua kanta*, Kamaon.

P. 20. Other species of *Tamarix*, of North-West and Central India, are 1. *T. salina*, Dyer; Hook. Fl. Ind. i. 248, a glabrous, glaucous shrub, with cordiform, subamplexicaul, strongly impress-punctate leaves; pentandrous (like *T. gallica, dioica*, and *articulata*). Salt range. 2. *T. ericoides*, Rottler.—Syn. *Trichaurus ericoides*, W. & A. Prodr. 40; Wight Ill. t. 24 B, Ic. t. 22. A small decandrous shrub, with foliage like the common Tamarisk, but larger flowers; seeds rostrate, beak straight, feathered with long spreading hairs. Common in the rocky river-beds of the Dekkan, often associated with *Rhabdia* and *Homonoya*. 3. *T. stricta*, Boiss.; Hook. Fl. Ind. i. 249, decandrous, hoary with impress-punctate glands. Sindh. Beluchistan.

P. 28. *Thespesia Lampas*, Dalzell; Bombay Fl. 19. *T. populnea*, Correa, the *Bendy* tree of Bombay, *Portia* tree of Madras.—Vern. *Poresh*, Beng., a fast-growing tree, with cordate, long-acuminate leaves, and close-grained wood, readily grown from cuttings, is often found in gardens and avenues of Central India.

P. 32, l. 20 from above, *read* " 4" *instead of* " 5."

P. 39. In Hooker's Fl. Ind. i. 387, the name *G. scabrophylla* is substituted for *G. sclerophylla*. The latter, however, is the older and more suitable name.

P. 40. *G. vestita*, Wall., should be called *G. elastica*, Royle, the name being supported by figure and description.

P. 44. *Hiptage Madablota*, Gærtn.—Sans. *Pundraka*.

P. 45. Hooker, in Fl. Ind. i. 421, calls the Garhwal and Kamaon plant, with subcordate leaves and silky white tomentum, *Aspidopterys Wallichii*, and the eastern plant, Nepal to Burma, leaves not cordate, *A. nutans*, Hook. f.

P. 47. *Zanthoxylum alatum* is found up the Sutlej valley as far as Wangtu.

P. 48, 49. *Limonia acidissima, Murraya Kœnigii* and *Clausena pentaphylla*, common in Burma, S. Kurz.

P. 50. *Skimmia Laureola*. Fl. sweet-scented, drupes with 2-3, 1-seeded cartilaginous kernels. Flowers both in spring and autumn, according to Madden, As. Soc. Journ. xviii. i. 606.

P. 50, line 16, add: leaves (of *Citrus*) more or less dentate.

P. 51 „ 25 „ Risso calls the five species accepted by him: 1. *C. Aurantium*, the sweet; 2. *C. vulgaris*, the bitter orange; 3. *C. Limetta;* 4. *C. medica;* 5. *C. limonum*. Risso and Poiteau classify what they call types or races, with regard to the shape of the oil-vesicles in the rind, as follows: *C. decumana*, with flat or convex vesicles, *C. Aurantium, Lumia, limonum*, with convex, *Bigaradia, Bergamia, Limetta*, with concave vesicles of oil in the rind.

P. 53, line 17, *read* " 2000 and 4000" *instead of* " 4000 and 3000."

P. 53 „ 22, add the following remarks concerning what are believed to be wild oranges on the Nilgiris. 1. *C. vulgaris*, Risso; Wight Ic. t. 957. On the slopes below Kotagiri and Kunnur (Nilgiris), apparently wild, with large elliptic dentate leaves, petiole more or less winged, flowers large, white; fruit orange-coloured, roundish or slightly elongated or depressed; pulp acid or bitter. 2. *C. Limetta*, Risso; Wight Ic. t. 958. In the Orange valley near Kotagiri, flowers Aug.-Sept., certainly wild; a low, very ramous, erect, thorny bush, covered during the flowering season with a profusion of beautiful white fragrant flowers; leaves ovate, dentate, petiole winged or margined; flowers small white, fruit pale yellow, ovoid or roundish, terminated by a knob; pulp watery, acid or sweetish, occasionally slightly bitter.

P. 56. *Feronia Elephantum*. Wild in the Prome district, Pegu, S. Kurz.

P. 58. *Ailanthus malabarica*. Forests of the Pegu Yoma, S. Kurz.

P. 60. *Ochna pumila*, Ham.; Don Fl. Nep. 224, add Syn. *O. nana*, Royle Ill. 165.

P. 61. *Bursera serrata*, in Burma.—Vern. *Thadīben*, S. Kurz.

P. 61, line 6 from below, read "*Boswellia serrata*, Roxburgh in Asiatic Researches, ix. 379."

The correct name of this common and well-known tree has not yet been finally settled. H. T. Colebrooke, in a paper on Olibanum or Frankincense, As. Res. ix. 377 (London edition of 1809), gives Roxburgh's figure and description of it under the name of *B. serrata*. Colebrooke found it frequent in the forest between the Sone (Soane) and Nagpūr (vern. *Salāi*), on the route by which he travelled to Berar in 1797, and came to the conclusion that it was the tree yielding the Olibanum of commerce. In a note at the end of his paper he stated, that if the genus had not already received a botanical name, it might have been suitably denominated *Libanus thurifera*. In a later volume of the Asiatic Researches, xi. 152 (Calcutta edition of 1810), Dr John Fleming published a catalogue of Indian medicinal plants, the names and characters of new species being, as he says, transcribed from Roxburgh's manuscript, and among them will be found, at page 158, *Boswellia thurifera*, Roxb. (*Salai*, Hindi). Fleming refers to Colebrooke's paper in the ninth volume, and there is no doubt that he means the same tree. It is evident, therefore, that Roxburgh, soon after the publication of Colebrooke's paper, probably by way of compliment to the author's suggestion, altered the name from *serrata* into *thurifera*. Since that time both names have been employed by different botanists.—Roxburgh Catalogue, p. 32, and Flora Indica, ii. 383, Graham (Cat. 42), and Wight & Arn. (Prodr. 174) adopt the name *thurifera*, while De Candolle (Prodr. ii. 76, 1825), Colebrooke in a paper on *Boswellia* (Trans. Linn. Soc. xv. 363, 1827), and Wallich (Cat. 8486) give the name *B. serrata* to the same tree. De Candolle quotes Stackhouse, Extracts from Bruce's Travels in Abyssinia respecting the Balsam and Myrrh Trees, Bath, 1815, as authority for the name, but Stackhouse, p. 19, calls it *B. serrata*, Roxb., and refers to Colebrooke's paper in the Asiatic Researches, from which he extracts his account of the tree. It cannot be said that either of the names has been more generally used by botanists, and, under these circumstances, the older name, *B. serrata*, ought to take precedence. There is, however, this against it, that the leaflets, though described as serrate, are obtusely dentate, and often entire.

B. glabra, Roxb., first described in the Coromandel Plants, iii. p. 4, is, as explained at p. 62, a doubtful species. Graham (Cat. 42) identifies it with the *Salai* of the bare rocky hills of the Dekkan and the Satpura range.

P. 67. In Burma, I have seen *Melia indica* and *M. Azedarach* only cultivated, but S. Kurz informs me that *M. indica* is wild in the Yoma hills of the Prome district, and I find a note in my herbarium that *M. indica* is wild beyond the British frontier. This is a subject for farther inquiry. According to Mason, the *Persian Lilac* is called *Kamakha*, and the *Neem*, which is cultivated by the Burmans on account of its medicinal qualities, *Thimbau kamakha*, indicating importation by ship (*thimbau*) from beyond the seas, as in the case of *Thimbau thī* (*Carica Papaya*) and other foreign trees introduced into Burma.

P. 68. Royle, Ill. 141, mentions two species of *Melia* in North India besides the *Neem*, one the *Bakāin*, the other the *Dek;* but Madden, in As. Soc. Journ. xviii. i. 638, points out that there is no difference between them.

P. 69. *Melia composita* has the inside of the staminal tube covered with white hairs, which protrude at the mouth.

P. 69. *Amoora Rohituka*, common in Burma.—Vern. *Thitni* (red wood).

P. 71. *Soymida febrifuga*, Burma.

P. 72. The characters here given to distinguish *C. serrata* from Toona demand farther inquiry on the spot. In Kunawar, *C. serrata* has its upper limit opposite Chergāon.

P. 75. *Cansjera Rheedii*. Common in Prome district, S. Kurz.

P. 77. *Ilex odorata*, Ham.—Syn. *I. serrata*, Royle. Vern. *Garshūn, Garkaula*, Kamaon.

P. 84. Several climbing shrubs of this Order are found in Central India and the sub-Himalayan forests, belonging to the tribe of *Gouanieæ*, with the ovary adnate to the calyx: 1. *Gouania leptostachya*, DC.; Wight & Arn. Prodr. 166. —Vern. *Kala lag*, Kamaon. Leaves ovate-acuminate, crenate, with 5-6 main lateral nerves, arcuate. Flowers greenish in long slender, panicled racemes, tendrils simple, generally at the base of racemes. Fruit dry, inferior, with 3 broad wings, ½ in. across, separating into 3 coriaceous, 1-seeded, indehiscent carpels. Sub-Himalayan tract of Kamaon. Bengal. 2. *G. microcarpa*, DC.; Wight & Arn. Prodr. 167. Similar, but racemes, branchlets, and young leaves rusty-tomentose while young; leaves entire, glabrous and subcoriaceous when full-grown, and smaller fruit. South and probably Central India. 3. *Helinus lanceolatus*.—Syn. *Gouania lanceolata*, Wall. A slender twining shrub with entire lanceolate leaves, branchlets ending in short simple tendrils, flowers umbellate, fruit obovoid, not winged, coriaceous. Plains of N.W. India, common in the sub-Himalayan tract of the Panjab and Kamaon, ascending to 4000 ft. Fl. in May, June.

P. 85, l. 10 from below, read "*Acajou*" for "*Acayou*."

P. 95. The shrub mentioned as *Paliurus aculeatus* in the Bussahir Forest Report, p. 63—Vern. *Thūm*, upper limit in Kunawar at Javi—is *Sageretia theesans*, Brongn. *Paliurus* is a shrub similar to *Zizyphus*, but fruit with a broad orbicular membranous wing 1 in. diam., of the Mediterranean region, common in Palestine, found east as far as Armenia, Kurdistan, and North Persia.

P. 96. S. Kurz informs me that the common *Ventilago* of Burma is *V. calyculata*.

P. 99. E. Regel, in a late paper on the American, Chinese, and Japanese species of *Vitis*, unites *V. parvifolia*, Roxb., with *V. vulpina*, Linn., and *V. lanata*, Roxb., with *V. Labrusca*, Linn. *V. vulpina* and *Labrusca* inhabit North America and Japan. In the same paper he advances the opinion, that *V. vinifera* is no original species at all, but the product of long-continued cultivation of the two last-named species. It is true that the grape-vine agrees with them as well as with *V. parvifolia* and *lanata*, in pentamerous flowers and petals cohering at the apex; but its cultivation commenced in Western Asia, and neither *V. lanata* nor *parvifolia*, nor any of the forms of *V. Labrusca* and *vulpina*, have, as far as I am aware, been found in Western Asia.

Pp. 99-101. *Vitis latifolia, lanata, indica, adnata, lanceolaria*, are common in Burma, S. Kurz. *V. himalayana* is found in Kunawar as far as Urni.

P. 102. *Leea macrophylla*. Common in Burma.

P. 104. At high elevations the Indian *Horse-Chestnut* is bare in winter, the young leaves appearing some time before the flowers. The buds are small and membranous, those of *A. Hippocastanum* are large and viscid. Cultivated in Kunawar, upper limit in the valley, Jangi on the right and Purbani on the left side.—Vern. *Pū*.

P. 114. *Staphylea Emodi*. Kunawar as far up as Chergaon.

P. 117. *Sabia campanulata* has purple, not green flowers; the flowers of *S. paniculata*—Vern. *Bakal pata*—Kamaon, are yellow, and the ripe fruit of an ultramarine blue (Madden).

P. 117. Character of *Anacardiaceæ*, add: ovary free.

P. 118. In Kunawar upper limit of *Rhus Cotinus* above Wangtu, and of *R. semialata*, Urni.

P. 122. *Pistacia integerrima*, J. L. Stewart. Upper limit in Kunawar: Urni on the right, and Kilba on the left bank.

P. 152. *Dalbergia volubilis*. Common in Burma, S. Kurz.

P. 154. *Derris robusta.* In Burma, vern. *Thitpagan*—read *D. Krowee*, Roxb.

P. 158. *Acrocarpus fraxinifolius.* Burma, S. Kurz.

P. 162. *Bauhinia Vahlii.* Burma, S. Kurz.

P. 167. Line 6 from below, read "*Mimosa scandens*, Linn."

P. 174. *Pithecolobium lobatum*, Benth., is a large tree in the moister forests of Burma, with large, lobed pods and seeds similar in size and shape to those of *Entada scandens ;* eaten as a condiment in Burma. Fl. Jan., Feb. (*Tanyin*, Burm.) Also Indian Archipelago.

P. 175. *Albizzia procera.* Indian Archipelago, Philippine Islands, and North Australia.

P. 176. *Albizzia Lebbek.* Burma, S. Kurz.

P. 177. *Albizzia Julibrissin.* In the Kunawar valley extends as far as Wangtu.

P. 179. *Albizzia amara.* In Kamaon, Madden.

P. 180. *Acacia arabica.*—Sans. *Khadira.*

P. 181. Line 24 from below, *dele* "uniformly distributed."

P. 183. *A. eburnea* has sometimes 5 or 6 pairs of pinnæ. The twisted and broad pod represented in t. 199 of Roxb. Cor. Pl. does not belong to this species ; it may possibly belong to *A. planifrons*, W. & A. Prodr. 276, a small thorny tree of South India, which differs from *A. eburnea* by having the shorter spines crooked, not straight. The *Acacia* from Kamaon(*Bhes*), mentioned at p. 180 under *A. Latronum*, is probably a villose variety of *A. eburnea.* This appears from the full description given by Madden in p. 631 of his second paper on the Terai and outer mountains of Kamaon (As. Soc. Journ. xviii. i. 631). Young branches, petioles, and thorns very villous with rufous down, pinnæ 3-5, leaflets 4-10; flowers white ; pods in umbels of 3-7, flat, smooth, linear, nearly straight, pendulous, 3-8-seeded, 3-5 in. long, less than a quarter of an inch broad, the border with a long shallow sinus between each seed. All this agrees well with *A. eburnea*, except the colour of the flower. Common in Garhwal up to the Ganges, but apparently confined to the banks of the streams and rivers where they enter the plains and Doons.

P. 184. Mr Bentham informs me that *A. rupestris* is closely allied to, and perhaps not specifically distinct from, *A. Senegal*, Willd., which is synonymous with *A. Verek*, Guill. et Perr., mentioned at p. 186.

P. 191. *Prunus persica*, cultivated in Kunawar as far as Sungnam on the right, and Morung on the left bank.—Vern. *Rek.*

P. 194. Line 6 from above, *read* "for" *instead of* "but."

P. 195. *Prunus Mahaleb.* Mountains of Greece in the region of the Silver Fir.

P. 196. *Prinsepia utilis.* Found in Kunawar as far as Urni.—Vern, *Bekling.*

P. 196. *Rubus cordifolius*, Don—Vern. *Katrola, katrota*, Almora, is, according to Madden, synonymous with *R. tiliaceus.*

P. 199. Two more species are mentioned by Madden in As. Soc. Journ. xviii. i. : *Rubus hypargyrus*, Edgew., with red flowers and yellow woolly fruit. Crest of Chinar near Naini Tal—p. 605. *R. affinis*, Madden, near *R. flavus*, Ham., very green and glossy. Gagar Pass, Binsar, to 7300 ft., in shade only—p. 624.

P. 202. *Rosa Webbiana.*—Vern. *Ring yal.* Commences at Pangi in Kunawar.

P. 204. *Pyrus Pashia*, Hamilton in Don's Fl. Nep. 236, is the older name, and should take precedence of *P. variolosa*, Wall. In Kunawar as far up as Urni.

P. 208. *Photinia japonica*—Syn. *Eriobotrya japonica*, Lindley ; W. & A. Prodr. 302 ; Wight Ic. t. 226 ; *Mespilus japonica*, Thunb. ; Roxb. Fl. Ind. ii. 510 ; Bot. Reg. t. 365 ; *the Loquat*—is a well-known fruit-tree, indigenous in Japan and China, and now cultivated in Bengal, South and North-West India. Leaves large, lanceolate or ovate-lanceolate, tomentose beneath, with prominent lateral nerves, flowers white, fragrant, in terminal tomentose panicles.

P. 216. *Parrotia Jacquemontiana.* In Kunawar near Shoang at 9000 ft.—Vern. *Shā.*

P. 219. Line 12 from below, read "*malabarica*" and "*parviflora.*"

P. 221. *Combretum decandrum.* Burma, S. Kurz.

P. 223. S. Kurz makes *Pangāh,* Burm., a distinct and new species, *T. tomentella,* marked by a glabrous smooth calyx-tube, smaller fruit, and more copious cupreous pubescence.

P. 226. For an account of the *Tusseh* silkworm (*Phalæna Paphia*), which lives on the leaves of *Terminalia tomentosa* and *Zizyphus Jujuba* in Behar, see Roxb. in Trans. Linn. Soc. vii. 33.

P. 246. According to another account, the *Prickly Pear* was destroyed in 1849-50 in the Jalandhar district. The insect was collected largely by the cloth-dyers, and yielded a brilliant colour.

P. 255. According to Dr Stewart, *Lonicera angustifolia* is common in Zanskar, Ladak, Nubra, ascending to 15,000 ft.—Notes of a Bot. Tour in Western Tibet, Trans. Bot. Soc. Edin. 1869, p. 207. Is this not *L. spinosa,* Jacquem.? *L. glauca,* H. f. & Th. Journ. Linn. Soc. ii. 166, a small shrub, with linear-oblong obtuse leaves, glaucous beneath, and large ovate-oblong ciliate bracts, common in Zanskar, Piti, Nubra, Pangong lake, Tibet, 13,000-16,000 ft.

P. 258. Madden (As. Soc. Journ. xviii. i. 609) gives the following additional vern. names for some of the *Viburnums* of the N.W. Himalaya: 1. *V. cotinifolium* (black fruit), *Gūya,* Kamaon. 2. *V. Mullaha,* Hamilton in Don's Prodr. Fl. Nep. 141, which name, being older, should take precedence of *V. stellulatum,* Wall., with abundant red, bitter fruit. *Eri,* Simla. 3. *V. fœtens,* Decaisne. *Gūya,* Kamaon; *Thelain,* Bussahir.

P. 260. *Sambucus adnata,* Wall.; H. f. & Th. in Journ. Linn. Soc. ii. 180, is an undershrub with furrowed branches and red berries of Sikkim (6000-11,000 ft.) Nepal, and, according to Royle Ill. 236, on the mountains of Kashmir (?)

P. 269. A species, nearly allied to *Wendlandia tinctoria,* is *W. puberula,* DC. Prodr. iv. 412. Leaves with less prominent lateral nerves, and long hairs, particularly along midrib and nerves. Corolla-tube funnel-shaped (not tubular, as in *W. tinctoria*), twice or barely twice the length of segments. Anthers linear (not elliptic, as in *W. tinctoria*). Common in Kamaon and Garhwal, ascending to 4000 ft. Nepal.

P. 282. *Rhod. Anthopogon.*—Vern. *Talsir,* Bussahir. Sans. *Tālīsa patra* (Madden).

P. 299. *Symplocos ramosissima* (*nervosa*), of Madden Journ. As. Soc. xviii. i. 625, is "evergreen, with beautifully glossy leaves, common on the north side of the Gagar Pass, and in similar shady places on Binsar, Būra Pinnath, and Panjok Khal in Garhwal, from 6000-8000 ft."

P. 303. *Fraxinus excelsior,* Linn.—*Ash. Esche,* German; *Frêne,* French. Weight 34-52 lb., according to Dr Hurst's edition of Tredgold, 454 (1871). Nördlinger's data correspond to 35-58 lb.

P. 304. In Kunawar *F. Moorcroftiana* is found as far as Spūi on the right, and Namgia on the left bank.

P. 305. *Schrebera swietenioides.*—Vern. *Ghant, ghanta* (not *ghaut*), *patali, ghanta parali* (*Bell Bignonia*), Bandelkhand.

P. 307. The name *Olea ferruginea,* Royle, ought to take precedence of *O. cuspidata* of Wallich's Catalogue, being supported by description and figure.

P. 310. *Ligustrum compactum,* common by brooks in the warmer valleys of Kamaon and Kyūntal near Simla, has a very bitter leaf.—Madden. As. Soc. Journ. xviii. i. 633.

P. 318. *Buddleia paniculata*—Vern. *Dūsheria;* ascends to 7500 ft. in Kamaon (Madden).

P. 334. *Pergularia pallida,* Kosilla at 4000 ft. (Madden).

P. 341. Edgeworth, Catal. of pl. found in the Banda district, maintains 3 species of *Rhabdia*: 1. *R. viminea*; 2. *R. sericea*, Edgew., with silky pubescence, stems procumbent, as thick as one's wrist, and 5-6 ft. long, abounds in the bed of the Sarju river, ascending to 2500 ft.; 3. *R. fluvialis*, Edgew. (*glabra* in List), wholly glabrous, very peculiar in habit, growing upon granite rocks in the bed of the Ken river, Banda, often submerged for weeks, its long branches hanging down into the water when the rocks are left exposed. These branches are so flexible and tough, that they may be tied in a knot without breaking.

P. 361. The following interesting data regarding the durability of *Teak* timber in Bengal were communicated to me by J. C. Marshman, C.S.I.: The fort of the Dutch settlement of Chinsurah was erected about the year 1695, and the beams, the scantling of which was, if I remember aright, 12 in. by 15, were brought from the Teak forests in Java. The settlement was transferred to the English Government about the year 1826, when the old fort was pulled down to make room for barracks, and the beams which I saw were all as sound and perfect as when they were put in. Moreover, the Shah-in-Shah, a vessel built at Cochin of Malabar Teak, which sank in the Sundarbans some thirty or thirty-five years ago, was authentically known to have been at the time more than a hundred years old.

P. 364. *Clerodendron Siphonanthus.*—Sans. *Barbara, brāhmani.*

P. 369. *Vitex Negundo.*—Sans. *Sinduka.*

P. 379. In a subsequent paper (Journ. As. Soc. xviii. i. 632) Madden calls *Tetranthera Roxburghii*, *Gar bijaur*, which is right.

P. 386. *Daphne papyracea*, Wall.—Vern. *Bhallu soang, bhalua*, Nepal, described and figured in As. Researches, xiii. 385, under the name *D. cannabina*, Loureiro. There are 2 varieties in Kamaon, according to Madden, As. Soc. Journ. xviii. i. 610; one with white flowers and yellow fruit, 4000-8000 ft.—the other with purple flowers and fruit, 7000-8000 ft.

P. 387. *Aquilaria Agallocha.*—Sans. *Aguru, agaru.*

P. 418. It is remarkable that the *Fig*, though a soft-wooded tree, is long-lived. Pliny mentions several aged wild Fig-trees in Rome, among others, one in the Forum existing in his time (70 A.D.) under the shade of which, according to tradition, the wolf had suckled Romulus and Remus. Whatever the truth of this and similar stories may be, the Fig-tree in Italy attains a great age.

Dr Cleghorn believes that the wild Fig-tree in Kaghan may be only *F. virgata.*

Garden Figs (with eatable fruit) have repeatedly been raised from the seeds of the wild *Caprifig*, and the two kinds are certainly of the same species.—(Targioni Tozetti, Historical Notes on the Introduction of Various Plants into Tuscany, Journ. Hort. Soc. 1854, 168.)

P. 424. In general appearance *F. tuberculata*, Wall., agrees with the specimens which Wallich distributed under *F. lanceolata*, Roxb. (Cat. No. 4512), and with the Burma specimens of *F. pyrrhocarpa*, Kurz. Roxburgh's description, and his Ill. in herb. Kew, No. 1736, also agree as far as they go; the question is whether the Burma shrub and the plant cultivated in the Calcutta Bot. garden show the same structure of the female flower. This I have been unable to verify. This species, whatever it may be called, should not be confused with *F. pyriformis*, Hook. & Arn.; Benth. Fl. Hongk. 328; Miq. Ann. iii. 294, a shrub with similar leaves, which grows in similar localities, in watercourses, and between rocks in torrents in East Bengal, Burma, and China, but has pedunculate receptacles in the axils of the leaves, and does not belong to the section *Covellia.*

P. 424. *F. Chincha*, Roxb. iii. 534, is (doubtfully) identified by Madden (As. Soc. Journ. xviii. i. 644), with *F. squamosa*, Roxb. 531. A shrub; at the foot of the mountains a small spreading tree (Madden). Leaves alternate, rough, 3-

nerved, with distant veins running into each other along the margin of the leaf; petioles very short, hairy. Fruit axillary, solitary, sessile, rough, globular, about the size of a small gooseberry (Hardwicke in As. Soc. Res. vi. 379).

P. 446. *Bischoffia javanica*, Blume; Bedd. Fl. Sylv. t. 259.

P. 480. A. De Candolle distinguishes *Q. Baloot*, Griff. (Afghanistan), from *Q. Ilex*, Linn., mainly by the pubescence on the under side of the leaves, "Stellæ planæ, parenchyma sub limbo tegentes iis *Q. Ilicis* triplo minores, puncto centrali magis distincto, radiis gracilioribus et multo brevioribus." I have been unable to trace any essential difference in the pubescence between the Afghanistan and Kunawar specimens on the one hand, and those of Spain, France, and Greece on the other. As regards shape and spinescence of the leaves, the Afghanistan and Indian specimens show the same variations as those from the Mediterranean; there is no difference in cup and gland, and the only point apparently of any importance is, that the anthers are hairy in all Eastern specimens, while the Mediterranean tree has sometimes glabrous, sometimes hairy anthers.

P. 553. The branching Date-Palm at Indore is figured in Jour. Ag. Hort. Soc. Ind. iv. N.S., 1873.

The following names of species should be written with small initials: *Berberis kunawarensis*, p. 12; *Salmalia malabarica*, p. 31; *Balsamodendron gileadense*, p. 65; *Zizyphus*, var. *hysudrica*, p. 87; *Piptadenia oudhensis*, p. 168; *Prunus avium*, p. 193; *Pyrus kumaonensis*, p. 206; *Aralia cashemirica*, p. 248; *Willughbeia martabanica*, p. 320. The following should have large initials: *Swietenia Chloroxylon*, p. 74; *Rhus Kakrasingee*, p. 122.

The spelling of the following Sanskrit and Arabic names should be corrected: *Swādu*, p. 18; *Sālmali*, p. 31; *Nāgaranga*, *Nāranj*, p. 56; *Mālūra*, p. 57; *Kachha*, p. 72; *Inab*, p. 98; *Nīlī*, p. 135; *Jayā*, *jayanti*, p. 137; *Sinsapa*, p. 149; *Kharavallikā*, p. 160; *Chukrā*, *chinchā*, p. 163; *Padmāksha* (doubtful), p. 194; *Baheduka*, p. 222; *Harītakī*, p. 223; *Dhātrī pushpitā*, p. 238; *Dālima*, *rumman*, p. 241; *Mallikā*, *asphotā*, *saptalā* (*Yāsmīn*, Persian), p. 311; *Ayugma chhada*, p. 325; *Karavīra*, p. 328; *Syonāka*, p. 347; *Tūla*, p. 408; *Kākodumbara*, p. 423; *Putranjīva*, p. 451; *Dhātrī*, p. 454; *Bhūrja*, p. 458.

ANALYTICAL KEY

ANALYTICA RTH-WEST HIMALAYA.

	1. **Pinus longi** **folia,** Rox.	**essus tor-** **sa,** Don.	8. **Juniperus excelsa,** Bieb.	9. **Taxus baccata,** L.
Crown. ...	Young, ovate; older, long ovate, with broadish top.	nical, like cypress.	Like 7, diffuse, irregular.	Broad oval, irregular.
Branches of a tree in the open.	Begin high, droop somewhat, then upcurved.	lowish, of horizontal, clining; of orizontal, drooping, ided tips.	Begin low, large, numerous, spreading, diffuse, an exaggeration of 9.	Trunk short or none, branches lax, irregular.
Colour of the foliage.	Young, light; old, dark green.	luish green; arker, like browner 3.	Grey, green; not unlike 3.	Darkish green.
Bark. ...	Rough, grey plates and deep irregular furrows.	mooth, sul- brous, peel- ff in long often sub- d.	Rather like 7, but smoother, and more flaky.	Young, silvery, old, smooth, brown, fibrous, compact, not sulcate, peeling off in layers.
Leaves. ...	6-18" long, in 3s stiff, erect, in persistent sheath, 6" 1" long.	e, quadri- ly close im-	As of 7 nearly.	Flat, falcate, entire, sharp mucronate, alternate distichous.
Duration of leaves.	2—3 years.	?	?	?
Cone. ...	Pendulous sub-globular or ovate young; old, conical, 5-7" long, 13 girth at base brown.	or sub- 3" long, 1½" fuscous, blu- aucescent.	Galbulus 5'6" diam.; young, yellowish green, ripe dark purple or black.	Sub-drupe, 4-5½" long, 1¼-1½" girth, cup red, fleshy, nucule greenish olive.
Scales. ...	With very thick knobby points persistent.	le with 4— s	...	...
Ripe. ...	(Oct.) Apr. May.	Nov.	September onward.	September to Jan.

SANSKRIT, ARABIC, AND PERSIAN NAMES.

Achyuta, 277 ; agaru, 577 ; agnivāla, 238 ; aguru, 577 ; ainab, 98 ; ākhota, 497 ; akshota, 497 ; alte, 502 ; āmalaka, 454 ; āmra, 125 ; amrātaka, 128 ; anār, 241 ; augūr, 98 ; ankola, 250 ; arāk, 315 ; aralu, 58 ; arishta, 106 ; arjuna, 224 ; arka, 331 ; arushkara, 124 ; asana, 225 ; asoka, 166 ; āsphotā, 311 ; asvakarna, 26 ; avigna, 320 ; ayugma chhada, 325 ; ayuk chhada, 325 ; azāddirakht, 67.

Badara, 86 ; baheduka, 222, 578 ; bandhuka, 275 ; barbara, 577 ; bed, 463 ; bhallātaka, 124 ; bhūrja, 458 ; bilva, 57 ; brāhmanī, 577.

Champaka, 3 ; chandana, 398 ; chāra, 127 ; chārmaghz, 497 ; chinār, 484 ; chinchā, 163 ; chukrā, 163.

Dālima, 241 ; devadāru, 516 ; dhātrī, 454 ; dhātrī pushpitā, 238, 578 ; drāksha, 98.

Eranda, 445.

Gunja, 139 ; guvāka, 551.

Harītakī, 223.

Inab, 578 ; irak, 315 ; irak-hindi, 316.

Jambīra, 52 ; jambu, 233 ; jambūla, 233 ; jayā, 137 ; jayanti, 137 ; jembūt, 171 ; jhāvuka, 20.

Kabbar, 14 ; kachha or kachchha, 72 ; kadamba, 261 ; kākodumbara, 423 ; kakubha, 224 ; kānchanāra, 160 ; kānchī, 139 ; kapītana, 128 ; kapittha, 56 ; karamarda, 320 ; karanjaka, 153 ; karavīra, 328 ; karkandhu, 86 ; karmara, 45 ; karma-ranga, 45 ; karnikāra, 35 ; kataka, 317 ; kendu, 294 ; kesara, 293 ; kesara, 444 ; khadira, 575 ; kharjūra, 554 ; kharvallikā, 160 ; kharzahra, 328 ; koli, 86 ; kovidāra, 160 ; kshīra, 507 ; kuberaka, 72 ; kuchandana, 168 ; kunda, 312.

Lakucha, 426 ; lāngalin, 557 ; lodhra, 300.

Madhūka, 289 ; mallikā, 311 ; mālura, 57 ; mandāra, 139 ; mendhi, 238.

Nāgaranga, 53 ; nāranj, 53, 56 ; nārikela, 557 ; nārikera, 557 ; nikochaka, 250 ; nīlī, 135 ; nimba, 67 ; nīpa, 261.

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Raktaka, 275 ; rohitaka, 69 ; rudrāksha, 43 ; rummān, 241.

Safēdār, 472 ; sāj, 354 ; sāka, 354 ; sāl, 354 ; sāla, 26 ; sālmali, 31 ; sana, 144 ; saptalā, 311 ; sarala, 506 ; savara lodhra, 300 ; selu, 336 ; sephāli, 314 ; setu, 16 ; sinduka, 577 ; sinsapa, 149 ; sirīsha, 176 ; sobhanjana, 129 ; sodāda, 14 ; surāhva, 533 ; suvarna, 164 ; swādu kantaka, 18 ; syonāka, 347.

Tālī, 549 ; tālīsapatra, 576 ; tinduka, 294 ; tinisa, 146 ; trinarāja, 544 ; tūla, 408 ; tunna, 72 ; tusha, 222.

Udumbara, 422 ; utrej, 52.

Vaka, 137 ; vakula, 293 ; vanjula, 166 ; vansa, 564 ; varana, 16 ; varuna, 16 ; vata, 413 ; vetasa, 559 ; vetra, 559 ; vījapūra, 52.

Yāsmīn, 578.

Zambac, 311 ; zin zeid, 389.

VERNACULAR NAMES.

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⁂ *The Synonyms are printed in italics.*

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